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[OFFICIAL NOTICE.]

Annual Meeting of the New England Association.

To the Members of the New England Association of Gas Engineers:—The Annual Meeting of this Association will be held in Boston, on February 16 and 17, 1887. The place where the meeting will be held will be announced, together with the detailed arrangements, in the next issue of the JOURNAL.

It is hoped that a large number of the members will be present, and only those will be absent who are detained by causes beyond their control.

There probably has never been a time when there was more necessity for these meetings of gas managers than the present. The demand for cheaper light, which is so universal, and the low prices at which many companies are selling their gas, renders the utmost economy imperative; and these meetings, with their papers and discussions, and the opportunities of interviews between the members, furnish the easiest and best means of obtaining the information necessary to produce this economy. The Secretary hopes that any member who has during the past year effected a saving in the production or distribution of his gas will write out in detail what he has done, and how he did it, and bring the statement with him to the meeting. Also, any paper on any subject relative to gas or gas manufacture will be welcomed.

CHARLES H. NETTLETON, Sec'y.

A WORD OR TWO CONCERNING 1886.

The year 1886 having been properly and according to most modern usage accredited to its niche in the collection of twelvemonths that preceded it, we may be excused, while some of its more salient features come crowding fast out of the mist that will so soon blot out the clear cut lines of even its most radical happenings, for granting these relics of the past a brief moment of resuscitation. If we do so it will be simply in hope that such rekindling may enable us—even if ever so slight success attend the attempt—to peer into the future, there to discover what 1887 contains for the gas men. In the first place, the experience of '86 all goes to show and prove that the past twelvemonth was one of almost unexampled expansion in the business of gas supply. We have at least two score of letters recently received in reply to as many queries made by us to men in different sections of the country, in regard to how the sendout averages of last year compared with those of its predecessor; and these responses, we are happy to say, are couched in one tone. They show, in fact, surprising results; and while we are not at liberty to furnish a key that would reveal individual situations, we may without any violation of confidence, state that in 41 different places in the United States—in none of them did the sendout exceed an annual total of 60 millions cubic feet, for we wished to estimate the rapidity or tone of the average circulation by applying the test to the pulse of the lesser gas bodies—the grand average percentage of increase shown figures out a trifle in excess of 26. There are many ways in which this gain may be accounted for; but above all the other reasons stands this one—the fact that the policy of cheapening sales rates has been steadily adhered to. Then, again, that policy has been made doubly effectual by the business-like practice of keeping the manufacturing and distributing plant in good working shape, which means that "skimping" once thrown aside will never again be resorted to—skimping, of course, being understood to mean the old-time idea that a superintendent was expected to get along with two benches of fives when three benches of sixes would hardly satisfy the requirements of the situation, or that he must perforce be content with a gasholder the dimensions of which would hardly be sufficient to recommend it to the favorable notice of a cook in case the latter were in quest of a goodly-sized pot. We have at the moment in mind a certain coal gas company whose proprietors, in 1884, were working along under the skimping process; but, the spirit having seized them, during the summer of the following year, they spent something less than $20,000 in plant betterment, etc. The leaven further worked to the extent that a liberal concession in gas rates was next granted, and in 1886 the owners divided a handsome cash dividend out of the earnings of the twelvemonth—the first dividend that had been earned on gas shares in that locality for six years.

One of the other notable features of the year has been the great decrease in the matter of opposition gas ventures. Perhaps the rebuffs which the Equitable operators met with in Newark, N. J., and in Syracuse, N. Y., may have made investors in this particular line more wary, and possibly the fate of the ground floor owners in the Consumers Company, of Chicago, Ills., with the lack of substantial pecuniary recompense secured so far in the case

of the Chesapeake Company's Baltimore (Md.) scheme had the salutary effect of causing Mr. Speculator to keep a tighter hold on his money bags; but we still incline to the view that, after all, cheap gas and a plentiful supply of it are yet to have the lion's share of the credit. Certainly, those factors kept the would-be benefactors out of Brother Wood's Syracuse district, and a like state of affairs, aided by a well-drawn contract, accounts also for the Newark opposition fiasco. There can be no doubt any longer that the gas fraternity of the United States have about made up their minds to embark in the electric lighting business on joint account with gas supply, and there can be no possible ground for not believing that many of those who sanction the plan are eminently well qualified to pass a dispassionate, just, and logical verdict in the premises. Summed up in a few words, these base their opinion on the fact that electric lighting has come with us to stay, and, being with us as a permanency, the gas man can supply it more efficiently, and at the same time cheaper, than can be done by those who would seek to control it as an independent, or rather, distinct, branch of commercial and domestic service. This, then, can be set down as one of the revolutions effected in the sentiment of the artificial lighting business during 1886. It, however, is a revolution that carries no terror in its train, for the fortress is already in the hands of the gas men. In fact the new recruit, raw though he be, will no doubt prove a handy and valuable acquisition to the garrison. It might also be added that '86 witnessed the erection of many new gas plants to operate in districts hitherto outside the pale of the gas man's domain, and although the exact number of additions cannot be here given, certainly not less than a baker's dozen can be counted up. In the matter of technical advance no great victory was scored during the twelvemonth, although it can be said that the outlinings of the past year enable us to predict that the advocates of regenerative firing will witness great activity in that sort of construction in this country with the current year. Death had not made many gaps in the ranks of the fraternity in the twelvemonth just ended, the most shining marks perhaps being found in the persons of the late Messrs. Brewer, of Massachusetts; Taylor, of Ohio; Munzinger, of Pennsylvania; and Tibbals, of New York. Missed and mourned are those who have been taken from us; but in the wild rush of the active business man of our nineteenth century sentiment hardly finds strength to stay the pace. Our Associations have progressed and prospered, and bid fair to outstrip the promises of the most enthusiastic of their founders.

So, then, having hastily glanced backward, the retrospection bids us look onward hopefully and contentedly to the months of '87. In fact we may even predict, great as was the success of '86, that that of its successor will be even greater. With the heartiest of good wishes, and our sincere thanks, too, to those who honored us with their confidence in '86, we hope to make the JOURNAL still more acceptable to them in the future. Without an axe to grind on their own behalf, it is the aim of its owners to fairly reflect those sentiments connected with our common calling that are best calculated to place that calling on the firmest sort of footing.

OBITUARY NOTE.—HENRY H. TIBBALS.

No doubt many other members of the gas fraternity of the United States have obtained greater nominal prominence in the profession than did the one whose name heads this brief obituary note; but we may honestly assert that none other bore himself with greater manhood, nor with exceeding rectitude. Straightforward and steadfast in his somewhat uneventful career—so far as change of possition and eccentricity of orbit are concerned—death has nevertheless created, through the taking off of Mr. Tibbals, a void in the hearts of those whom he served so faithfully and well that even years will not obliterate. Deceased had suffered with patience for many weary months, and welcomed at last the approach of the scythe-bearer, of whom it has been written, "He destroys but to save." Relief came on the morning of December 15, and the end of his journey may be likened to the even pace that marked his travel through life. Mr. Tibbals was born at Durham, Conn., on October 3, 1829, and the fall of 1853 found him in the service of Messrs. H. Esler & Co., proprietors of the Atlantic Dock Iron Works, whose shops were located near the Atlantic Basin, in South Brooklyn, N. Y. Deceased acted for the Messrs. Esler in a financial capacity, and was greatly esteemed by his employers. In 1862 Mr. Tibbals cast his fortunes with those of Mr. Thos. F. Rowland, Proprietor of the Continental Iron Works, at Greenpoint, N. Y., in whose service he remained to the end. We have used the word "Service," but the relations that ever existed between the deceased and Mr. Rowland make it but poorly expressive of those that were maintained between them. Deceased was a director in the Mechanics and Traders Bank, of Greenpoint, and for years had served as vestryman of the Church of the Ascension. The remains were removed, on date of December 18th, to New Haven, Conn., for interment. Having lived an upright life, he leaves that best of heritages—an unsullied name—which, when recalled by the flash of memory, will, unlike the golden coin, grow brighter with the lapse of time.

[OFFICIAL REPORT.—Continued from Vol. XLV., page 363.]

Fourteenth Annual Meeting of the American Gas Light Association.

HELD AT THE ACADEMY OF MUSIC, PHILA., PA., OCT. 20, 21, AND 22, 1886.

SECOND DAY—THURSDAY, OCT. 21—AFTERNOON SESSION.

The final business session of the Association was called for 2 P.M. of October 22. At that hour the President introduced Mr. A. B. Slater, of Providence, R. I., who read the following paper on the subject of—

THREE-HOUR CHARGES.

There can, I think, be very little doubt in the mind of any member of this Association that whatever measure of success attends our meeting is largely due to the indefatigable efforts of our modest but energetic Secretary. In his zeal to work up and prepare subject-matter for consideration and discussion at our present annual gathering he forwarded to me a sort of mandatory order to write a paper upon "Three-Hour Charges." Knowing he was very well aware that in June, 1885, I read before the Society of Gas Lighting, at New Haven, Conn., a paper upon the same subject, and thus subjected myself to the subsequent criticism of such distinguished critics as the respective editors of the London *Journal of Gas Lighting* and the *Journal des Usines a Gaz*, I am rather at a loss to divine his motive. Whether he thinks there may be something worthy of thought and examination in such a departure from the old and long beaten track, or whether he wishes to set me up as a target to be shot at by the "old guard," I cannot decide; but, as our friend Pratt, of Jamaica Plain, Mass., said at the Pittsburgh meeting, "I am not thin skinned," and have endeavored to obey orders.

While I do not expect to say anything new upon the subject, the paper may perhaps open the way for discussion which will tend to convince some of the members that it is better for them to continue their system of four or five-hour charges, while it also may possibly lead others to investigation and experiment—where the necessary conditions can be reached—by keeping them in mind of the fact that if it is possible to run three-hour charges successfully and advantageously in one works it is certainly possible to do so in others.

I take it for granted that there are few, if any, of the members of this Association who have not outgrown the antique system of six-hour charges, notwithstanding the fact that after their long experience, coupled with their acknowledged ability, our English friends still adhere to the six-hour schedule in burning off a charge of coal. Without doubt they have their reasons for continuing that practice. It sometimes may be the case, in our zealous efforts to improve, that we in reality progress backward; still I believe it is true that Americans as a rule, whether engaged in the gas business or in any other commercial enterprise, have been steadily successful in their efforts for improvement; and if we investigate any line of business to-day we will find that few continue wholly in the use of ways and methods which were in vogue ten (or even five) years ago. One of our most conservative and valued instructors, when desiring to impress upon the minds of his pupils the fact that it is well not to go too fast, nor yet too slow, but to try and be able to distinguish between the visionary and the real, would quote the old adage, "Be not the first new things to try, nor yet the last to lay the old aside."

"The convenient duration of charges," said our London critic, "is one upon which every experienced manager has his mind fully made up." Were that remark applicable to the managers of this country, then the reading of this paper, and any discussion on the subject by the members of our Association, would be time wasted. But our experience leads us to hope that such will not be the case.

The first successful departure in this country from the old furnace—and which, as a generator furnace, produced conditions that made possible the carbonization of a fair quantity of coal in three hours—was effected in 1878 by Mr. Charles F. Dieterich, the accomplished Engineer of the then Peoples Gas Works of Baltimore, Md. His retorts were small—being 12 in. by 20 in. and 8 ft. in length—yet he carbonized 1,250 pounds of coal per bench every three hours as well as it is usual to see when the coal is allowed to remain in the retorts for four hours. It is a common notion that in order to properly work off a charge of coal in three hours an excessively high heat is necessary; but that is erroneous. Trouble is more likely to come when the heat is high and the small charges allowed to remain in the retort too long. In any system of furnaces, or combination of furnace, retorts, and settings, it is important that judgment be used in charging the proper quantity of coal according to the degree of heat maintained in the retorts.

Under the old method of working, when a charge of coal is introduced into a retort the heat is at once reduced, being absorbed by the vapor distilled from the coal, a large portion of which is not converted into gas, but carried on to the tar well. The conditions constantly change, according to the degree or quantity of heat which is generated, or until, after a short time, a sufficient temperature is developed to break up or convert more of

the vapors; and if one bench were running, and the retorts were all charged at once, we would find under ordinary circumstances that the larger portion of the gas came over during the middle portion of the time, even when a three-hour charge is run. If the charge is allowed to remain in the retort for five or six hours, during the latter portion of the time little or no gas would come over, and after the end of the third hour the heat of the retort would constantly increase, according to the conditions under which combustion is effected in the furnace, and the escape of heat from the bench by radiation and otherwise. In fact, were we able to get at the actual conditions in the retort during the time the coal is being distilled we would probably find that great changes were taking place; and in proportion to the degree or variation of these changes or conditions we fail to secure perfect work.

With a furnace capable of generating and keeping up, or constantly maintaining, the necessary quantity of heat, because of there being no necessity for drawing the fires for clinkering the furnace, and thus allowing draughts of cold air to cool off the retorts, we are able to secure a greater quantity of and a more constant heat in the retorts; and in drawing the charge at the end of three hours the more extreme conditions are avoided. Thus we have one explanation of the reason why we are able to carbonize more coal in a retort during the 24 hours than is possible to do with the old-style furnace, with which four or more hours for the proper carbonization of the coal is a necessity.

Formerly it was said that if over 4.50 or 4.75 cubic feet of gas per pound was extracted from the coal, trouble with naphthaline was sure to follow; but I have seen the flow of gas through the inlet and outlet pipes of a gasholder very greatly impeded by the deposit and accumulation of naphthaline, even when the yield of gas per pound was less than the minimum figure above given. Again, when the use of oil and naphtha was commenced, it was said that naphthaline would never be deposited; but it is no uncommon thing to hear it said that greater trouble takes place when oil is used. Within a few months samples of a mixture of hard soot or carbon, naphthaline and tar—the mass somewhat resembling soft coal—were shown me that were taken from the hydraulic main and tar tank, being the results of an accumulation following the use of oil as an enricher.

There is, no doubt, truth in the remark that blind prejudice and bigotry exercise too great an influence on our minds; and that is equally true whether these influential factors pertain to the mainufacture of gas or to religious or other affairs. We are too apt to jump at conclusions, and too prone to decide without proper investigation into cause and effect. At one of our meetings, held some years ago, during a discussion on condensation and elimination of tar from the crude gas, a member was asked how he got the tar out of his gas. His prompt answer was, "I knock it out." While his answer excited a smile then, it embodies a recognized principle now. So it is to-day; if we should visit a retort house where three-hour charges are the rule, and should notice a stopped stand-pipe, the first remark would probably be, "I told you so." Again, if we should see a scrubber stopped up with an accumulation of naphthaline, we would be very likely to attribute the cause of the trouble to charging every three hours; or as if no such trouble happened where the retorts are charged but once during every four or five hours.

During the spring and summer of 1880, having visited the Peoples Works at Baltimore and examined the practical working and results obtained by Mr. Dieterich with his furnace—which at that time was the only one constructed upon principles almost entirely different from the furnace in common use—we made arrangements with him to introduce them into our Langley street Station at Providence. We first constructed a stack of eight benches, set back to back, and fired them up the latter part of the same year—that is, 1880. As we had other benches in operation at the same time, we could not determine the results obtained from this stack of benches save by the quantity of coal which they carbonized. We started and continued for a short time on four-hour charges; but finding we had no difficulty in securing almost any degree of heat desired, and acting under the advice of Mr. Dieterich, we changed from four to three-hour charges, and have continued them without interruption since that time.

We find that although we handle more coal, yet the cost of labor per thousand cubic feet of gas is less than when four-hour charges were the rule. Less labor is required to take care of the furnaces. Circumstances and conditions, as well as proper management, govern the cost of labor in the manufacture of gas. In small works the coal may be near at hand, so that the stokers can wheel it into the retort house. At other works the coal may have to be wheeled or carted a longer distance, thus necessitating increased cost of labor. Latterly mechanical appliances have been brought into use for handling the coal, which innovation has reduced the cost of labor.

On a subject of such importance much more might be said, but I have already taken up too much of the time of the Association. In December, 1878, Major G. W. Dresser visited Mr. Dieterich at the Peoples gas works of Baltimore, and made an examination of the operation of the Dieterich furnace, in connection with three-hour charges, results obtained, etc.—the conditions in the main being similar to ours, with the exception that our arches are 7½ ft. by 9 ft., and formerly took the ordinary 14 in. by 26 in. by 9 ft. retort, but we now use the Davison retorts; and the investigator thus summed up his conclusions:

"1st. A more perfectly uniform heat throughout the bench than I have ever seen by any other method. The retorts appear to be uniformly heated up to the mouthpieces. The upper and lower retorts are heated alike. There is no flame to be seen in the bench by taking out any of the stoppers. There is no flame at the chimney top, or top of the bench, excepting at the moments of clinkering. No *cold* air can possibly get into the bench.

"2d. The charges are as thoroughly burned off in three hours as they would be in four hours by the old method.

"3d. The illuminating power of the gas is fully equal to that obtained by the old method, with the same coals, and a slightly smaller percentage of cannel.

"4th. The character of the labor required of the men is not nearly so trying as by the old system, The stokers have no fires to attend to or clinker, which all know is by far the most exhausting labor in the retort house; and, although they have to charge and draw oftener, the work is easier than when the fires have to be attended and the charges no less frequent.

"The skill required for keeping the fires going and keeping the heats up is reduced to a minimum, as one man can attend the fires for 14 benches with great ease, and, from the arrangement for clinkering, very little practice will enable anyone to manage the fires. In case of a strike this is an important item.

"5th. One-third of the coke made is more than enough to keep the furnaces supplied with fuel, although this would depend upon the character of the coal used and the nature of the coke obtained from it."

Discussion.

Mr. Harbison—I am not entirely familiar with the working at Providence, and I would like to inquire whether Mr. Slater adopted three-hour charges at both stations, and in making all the gas produced on the Providence works.

Mr. Slater—We have.

Mr. Cole—What is the difference in the weight of coal charged as between three and four-hour charges?

Mr. Slater—As said in the paper, our retorts are larger at the back end, and so take a little more coal, than the ordinary ones. We charge all the way from 260 and 275 pounds up to something over 300 pounds, every three hours.

Mr. Cole—Did you charge the same weight when you ran four-hour charges?

Mr. Slater—No; we would make a little difference in the rate when running four-hour charges. We would not carbonize the same quantity of coal in 24 hours that we do in running three-hour charges.

Mr. Harbison—For practical working, then, the facts are one can carbonize more coal and produce more gas per bench by running three-hour than when running four-hour charges.

Mr. Slater—Yes; provided you have the necessary heat.

Mr. Harbison—As I understand it, you have no trouble in getting the requisite amount of heat to carbonize three-hour charges; and that, as you can get the requisite amount of heat, you can get better results in quantity of gas made by working three-hour charges than when working four-hour charges. Not only so, but at the same time you reduce the cost for labor. The latter is the only point in which there is a reduction, except that you get a larger quantity of gas per bench—which, on repairs account, if the retorts will last as long, would be also a gain. I would like to ask Mr. Slater what his experience is in the matter of percentage of coke used in three-hour charges when compared with that burned with four-hour charges.

Mr. Slater—As a rule, I think we use, on the average, a little over 25 per cent. As stated in my paper, many think that because we run three-hour charges we are running under excessively high heats. Such is not the fact. We do run at a good, high heat, yet if we ran much higher than many of you gentlemen do we would melt everything down. It is simply a question of keeping the heat constant, and not allowing the retorts to be cooled by dropping the fires and clinkering, or by allowing cold draughts of air to go into the furnace and bench.

A Member—Do you think you would obtain the same results from the D-retorts?

Mr. Slater—I do not think we would carbonize quite as much coal. I think there would be a difference in favor of the retorts we are using. We have not tried the ordinary retorts with the Dieterich furnace, but from the time we commenced using that furnace we were able to carbonize a considerably greater quantity of coal with the Davison retorts. Although we have not tried the ordinary retorts with the Dieterich furnace in running

three-hour charges, I think that we would carbonize more coal with the Davison retort, for the latter has a larger floor surface.

Mr. Littlehales—How do you account for the saving in labor?

Mr. Slater—One man is able to take care of a greater number of furnaces, and that permits the stokers to attend solely to their duties of drawing and charging.

Mr. Littlehales—But, given a certain number of retorts for a given amount of work—say two benches of sixes—and that puts more labor on those men if they have to charge every three hours than if they charged every four hours. Is it because you are getting more out of the same men, or is there greater facility in some other way? Where can the labor be saved?

Mr. Slater—I think, as a rule, the men do handle a little more coal. I am not able to state from memory exactly what the cost of labor is now, but it is considerably less than it used to be.

Mr. Hyde—What percentage of coal carbonized can you get from three-hour charges over that obtained from four-hour charges? How much more coal can you carbonize?

Mr. Slater—I would have to figure that up before answering.

Mr. Stiness—The charges are a trifle lighter than they would be in four-hour charges, and you charge a little oftener.

Mr. Slater—They are a little lighter, but the fact of being able to get in two extra charges in the 24 hours more than compensates for that difference.

Mr. Hyde—Is the cost for fuel, in proportion to the coal carbonized, less in three-hour charges than it is in four-hour charges? Would it take more fuel to the ton of coal in carbonizing three-hour charges than in the case of four?

Mr. Slater—It takes less.

Mr. Stiness—What is your daily average yield per mouthpiece?

Mr. Slater—During last year I think the average was something like 11,400 feet.

Mr. Hyde—In 1878 I made an experiment with three-hour charges. I first ran a bench four hours, and ascertained the result in pounds of coal carbonized, and also the amount of fuel used. Then I tried, for the same length of time, the three-hour plan. The figures showed that we carbonized 13 per cent. more coal, at a cost of 6 per cent. more for fuel used per ton of coal. That is, it took more fuel to carbonize a ton with three-hour charges than it did with four.

Mr. Slater—Did you fire with hot coke?

Mr. Hyde—No; with cold.

Mr. Slater—We fire with hot coke.

Mr. Beale—How large are your retorts?

Mr. Slater—I have not got the number of square inches of floor surface in mind, but I have stated it several times. It is something larger than the ordinary retort.

Mr. Stiness—Is it really any more work to charge every three hours? Do the men notice the difference in labor?

Mr. Slater—I do not think they do. We never heard any objection to it.

Mr. Spaulding—Are the results obtained so satisfactory to yourself that you propose to continue three-hour charges?

Mr. Slater—We have been continuing them for five or six years, and we do not propose to change.

Mr. Lansden—Do you find that three-hour charges wear out your benches any quicker than four-hour charges?

Mr. Slater—I do not know that I see any special difference in that. We have had retorts last for three years; and we have used them up in one year. The last stack reset consisted of eight benches, and the average life of each retort, for the whole bench, was 532 days. The average quantity of gas produced by each retort during its lifetime was a fraction less than six million cubic feet.

Mr. Cole—Is there any difference between three and four-hour charges in respect of the accumulation of carbon?

Mr. Slater—We did not notice any difference in that regard.

Mr. Sherman—What yield do you get per pound?

Mr. Slater—Taking it for the whole year, we will not vary much from an average of 5 feet.

Mr. Sherman—How much more would you get if you had four-hour charges?

Mr. Slater—I do not think there would be any noticeable difference. I think we really get a better quality of gas by dropping off the last hour. You who run four hours know that the poorest quality of gas is obtained in the last hour of the charge. We get a better quality of gas in three-hour charges than we would in four.

Mr. Sherman—You get the same yield, and charge the same quantity of coal in three hours that you did in four?

Mr. Slater—We get the same yield per pound, but we have a better candle power.

Mr. Cabot—You spoke of getting 5 feet per pound of coal. Is there any enricher with that?

Mr. Slater—During the last year we used cannel as an enricher.

Mr. Cabot—In what proportion?

Mr. Slater—In the coldest winter weather we used about 10 per cent.

Mr. Taber—The President has put in some new benches, and I would like to ask him if he has used three-hour charges.

The President—We have never tried three-hour charges at Syracuse, but have occasionally compared results with Mr. Slater. We charge more heavily than he does. I remember that last July he had some very handsome results from 20 days' running in that month—perhaps a little above the average of the working results for the year. He thought the figures were good enough to send to me; and on receiving them I turned to our carbonization book, took off a statement for the corresponding days, and sent it on to him. I extended a column (he did not have it in his statement) in the item of "candle feet." In the production per mouthpiece Mr. Slater had beaten me a little, though not very much; but in the column showing candle feet merely I beat him quite handsomely. We have compared results from time to time, and there is not a great deal of difference in our working results as between the two systems of three and four-hour charges. He uses a somewhat lighter charge of coal. His work is all done with a regenerative furnace; ours only in part. With us about 66 per cent. of the gas was manufactured by the regenerative furnace, and the balance with a furnace of the common sort. Of course we had to excel him in the candle power of our gas in order to lead him in candle feet. We do not use as much cannel as he does; but that is all owing to the apparatus we have for manipulating the gas. With our apparatus we find it necessary to use not to exceed an average for the year of about 5 per cent. of West Virginia cannel.

Mr. Slater—Mr. Beale inquired the relative difference in floor surface. In the retort that we use the approximate number of square inches is 2,924; in the ordinary retort it is 2,600.

On motion of Mr. Cabot, a vote of thanks was tendered to Mr. Slater.

The President now called upon Captain W. Henry White, of New York city, to read his paper entitled—

A NEW DEPARTURE IN GASHOLDER HOUSES.

The author read as follows:

In no other portion of the work incident to the erection of a gas works is the serious attention of the engineer so challenged as in locating, designing and constructing the gasholder and its tank. Frequently this is the only part of the work calling for more than ordinary skill and judgment. The contiguity of valuable structures, the nature of the soil, and labor of excavating to great depths, the haps and mishaps of fitful weather, all combine to make this a work of the first importance, outside of any consideration of its heavy cost.

Granting these facts of cost and skill implied in holder construction, the engineer has but partially satisfied the requirements of his work, who will be content to leave, to the mercy of the storms of our northern latitudes, this important and costly structure without some earnest effort to secure proper covering buildings for its protection. To the engineer the necessity, advantages and economies of such protection are evident facts; but to the directors, who rule the financial affairs of the company, the other equally potent facts—increased cost of construction and additional interest charges—are too frequently permitted to outweigh the known benefits to be secured; and this possible, but to their minds somewhat intangible, benefit is lost sight of and sacrificed to present economy—into whose capacious maw many well designed improvements pass yearly. Experience comes to us through many channels; and pleasant, or the reverse, is no less costly to the gas engineer than to his fellow man.

Years ago the writer stood, in a heavy snow storm that made doubly dark the wild and threatening night, and with emotions as deeply stirred and tempestuous as the ever-shifting wind about him, looking at the wreck of what had been his largest, newest and best gasholder—a much-needed and reluctantly-granted increase of storage room in a works with a daily output that then trebled its holder capacity. As I contemplated that wreck, and considered whether a punishment could be invented adequate to the deserts of the faithless employee whose carelessness had aided the power of the storm, and recalled the pressing demand of the district in the then holiday season for gas, it may safely be asserted that no mourner at the memorable "Burial of Sir John Moore" could possibly so "bitterly thought of the morrow."

Out of the experiences of that wild night, and the recollection of the anxious days that followed it, came a firmly settled resolution to always house a gasholder whenever the decision upon the matter rested in my control.

Naturally the entire ground of discussion bearing upon the practical value of these covering structures has been well and thoroughly ploughed in the intervening years; and all the holders constructed under my charge during those years have not been "housed"—"old times and old manners" change slowly, and to those of us who, more impatient, would make things move

more rapidly, is committed the removal of such stumbling blocks as lie in the pathway of the special reform or change we personally desire. Admitting, as most managers of gas companies readily do, that a covered holder is in all senses a much better apparatus and more efficient than an exposed one, what is the reason that to-day so many costly structures are daring the elements throughout the stormy northern country? Experience answers that the costly character of the buildings necessary to protect these holders has prevented their erection. "Vanity of vanities" are all the arguments upon the subject of the many small savings, the added duty of the holder, and the security when Present Cost—with a large capital P—stands watchdog over the treasury. To secure, therefore, a covering structure, substantial and durable, amply protecting and guiding the gasholder, at a cost little, if any, in excess of the suspension frame used on exposed holders, became one of the objects of my engineering quest. This might be secured by a frame house, but so many good objections hold against such a structure that it was given only a brief consideration.

The whole gamut of brick and stone buildings, with various ideas of roofs, was run through at all sorts of times, in all sorts of places, in hope of finding some construction that would touch the happy medium between cost and substantiality; but gradually faded idea after idea, plan followed plan in dreary procession across the drawing table into the waste basket, and the search would languish. But the fatal poison was in the blood, and again and again that holder-house was in hand. It had been taken to church, to theater, to horse races, to bed with me; it became a veritable "Old Man of the Sea."

City life gives us many new ideas with its daily object lessons, its ever-shifting kaleidoscope of sights, and, without knowing just how, we frequently imbibe a valuable suggestion from the most unpromising source. When I say that my "long days of anguish and nights devoid of ease" found surcease from the suggestions from an exhibition of a novel fire escape ladder—at which I "assisted" the assembled bootblacks and newsboys on lower Broadway one sunny day—the connection may not seem clear, and the relations between that iron ladder and my recent achievement in holder houses seem "rather far fetched," but that was the germ, the ovum out of which the present structure was hatched.

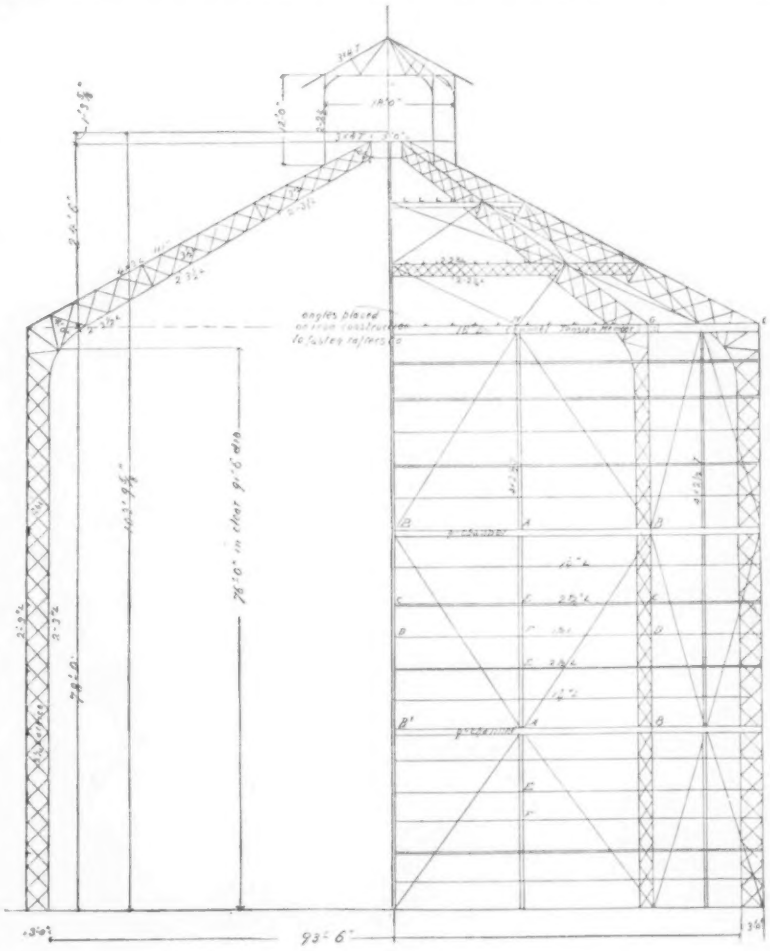

Fig. 1.

I will not further take up your time to give in detail the intervening steps by which my fire-escape ladder grew into a lattice girder and roof truss, and that into my *covered suspension frame* (for after all that is the story of the house in a sentence), suffice it that it grew in the odd hours of a busy life into definite form and feature, when, abandoning all other material, the construction of the house entirely of wrought iron was decided upon. The framing of a building, in Chicago, for the housing of a war cyclorama, by a daring architect, in much the same line of work, gave me the longed-for opportunity to study out several unsettled points in construction, and supplied valuable data as to strength of materials and strains; but, beyond all, positively settled the question of cost. The next step was taken this past summer in designing such a housing for the St. Paul (Minn.) Gas Light Company's holder, and the "new departure in gasholder houses" was made. I regret at this writing I cannot say that it is a completed work. Our friends, the Knights of Labor, contributed their share toward delaying the commencement of the work; the rolling mills added their quota; while sub-contractors on the work seemed, in many things, to study "how not to do it;" but for all practical purposes the building is sufficiently completed to show the correctness of the plan of the designer.

Description of the Building.—The size of the holder and its covering building was forced upon the designer by the necessity of securing, upon a lot 100 ft. by 100 ft., the utmost storage capacity compatible with its dimensions, safety, and any pretense to preservation of architectural symmetry in the structure. Resultant from this problem is a tank of brick 91 ft. 6 in. inside diameter, and 26 ft. deep, with walls varying in thickness, from 4 ft. at bottom course to 2 ft. at top. The tank has 8 piers, 4 ft. deep by 3 ft. wide. The loose sandy soil in which the tank is built necessitated intermediate piers for sustaining the pressure of water in the tank, and the lot, being upon a sharp slope of nearly 11 ft. from its upper to its lower side, involved the introduction of a retaining buttress wall on the lower side. The gasholder is a triple lift having a trussed crown. Its several sections are of following dimensions:

Lower section	89 ft. 6 in.	by 25 ft.
Middle section	88 ft.	by 25 ft.
Upper section	86 ft. 6 in.	by 25 ft.

The building, which is to act as guide frame and covering, is constructed entirely of wrought iron; is octagonal in shape, 117 ft. in height, over all, 93 ft. 6 in. in inside diameter, and 78 ft. in height from curb to foot of roof. Each of the eight sides of the building has three windows in its elevation—excepting the two sides which are fitted with doors. These contain but two windows each. Thus, with 22 windows and two double doorways, the need for light, ventilation and facility of access has been amply provided for. The roof is an octagonal pyramid, having a rise of 27 ft., and is surmounted by a lantern conforming to the shape of the main building, and of proportionate size. This lantern is fitted with eight small windows, and the single piece of cast iron in the body of the structure constitutes its finial cap. The entire structure is covered with No. 26 corrugated galvanized plate iron, riveted together, and securely fastened to the framing.

The frame is composed of eight wrought iron lattice girders, each constructed so as to form a continuous girder from pier-head to compression ring in the roof. These girders (or principals) are built of heavy angle iron, reinforced at the point where they curve from the vertical to horizontal incline (to form the roof trusses) with plates of boiler iron. They are 3 ft. in depth by 7 in. on the face at the pier-heads. A little below, and again beyond the point of divergence from the vertical line the lattice widens to 4 ft., but decreases from that to 2 ft. at the compression ring. The foot of the lattice is fastened to a cast iron sole-plate fitting the pier-head, to which this plate is secured by the usual holding-down bolts built in the piers. The upper end of the lattice is fastened to the compression ring by angle plates, and a $\frac{1}{4}$-inch boiler plate, canonical head, which extends down the truss 18 inches, and to which it is securely bolted. The uprights are spaced 38 ft. $\frac{1}{16}$-in. from centers on outside chords. The compression ring is 10 ft. in diameter, and 2 ft. 3 in. deep, and is built of $\frac{5}{16}$-in. boiler iron, strengthened by angle iron curbs. The eight girders and this ring form the principals, both of the building and of the roof, and are, at the same time, the suspension frame for the gasholder. The diagrams distributed to you possibly convey a clearer idea of the arrangement of these lattice girders and the frame generally than my description, and I invite your attention to them.

Fig. 1 illustrates the framing; fig. 2 the roof plan; and fig. 3 the footing of the girders upon the pier-heads. The girders are tied together at the foot of the roof by a 16-inch channel beam, tension member, and at two lower points by two 9-inch channel beams, all extending around the whole building, giving it great stiffness. The spaces between these beams are subdivided by six $2\frac{1}{2}$-inch and nine $1\frac{1}{2}$-inch angle bars, alternating, and also ex-

tending around the building, to which the corrugated iron plates are fastened.

A secondary framing is secured by dividing the vertical spaces between the principal trusses with a 5-in. by 4-in. T-iron upright, which extends from the bottom curb to tension member, and is securely riveted to each channel beam and angle iron at its intersection.

Diagonals of 5 in. by ⅜-in. bar iron, springing from the principals, are secured to this T-iron upright, and, uniting with the diagonal bracing of the roof, form a continuous brace from side to compression ring through the whole framing.

The roof trusses, formed by the lattice principals, are bound together, at a point 15 ft. above the tension member, by a lattice work girder, 24 in. deep, constructed of 2½-in. by 2½-in. angle iron, and 2½-in. by ⅜-in. bars. At another point 30 ft. 6 in. above the tension beam a plate girder is bolted between the trusses. These circular struts also serve the purpose of supports to the secondary rafters of wood, 2 in. by 8 in., upon which the board sheathing of the roof covering is laid down. Diagonal braces of 4 in. by 2½ in. T-iron are introduced between the tension beam and lattice work strut, and of 1¼-in. round iron between the lattice and plate struts, to give additional strength to the roof.

The lantern is strongly framed of angle and T-iron, suitably braced, and is securely bolted to the main girders, and is covered with same plating as the main building.

The windows, numbering 22 large and 8 small ones, are all wooden-framed, double-sashed, and have twelve 8-in. by 12-in. lights of glass each. The two double doors are plain, panelled, wooden ones, 7 ft. 6 in. high by 2 ft. 6 in. wide, and have glazed segment heads.

The cost of this building completed was $10,000, but the experience gained in erection will tend to diminish this cost in similar structures; for like all ventures into new fields—even though, as in this case, it is only the application of well-known material and principles of construction to new uses—better arrangements are suggested by the practical work of erection and use. While the writer now sees where changes might be of advantage, yet the structure as it stands is an ample demonstration of his theory that a substantial, fire and storm-proof holder house can be erected at an expense not exceeding, if even equal to, the cost of a properly-designed suspension frame. Nor does he feel that the use of such a construction must necessarily be confined to the larger holders, but would apply it to holders of sizes ordinarily found throughout the country.

Without claiming any of the laurels of an inventor, the writer modestly presents this idea of covering holders to the thoughtful consideration of his fellow members, confident that they are impressed with the need of some such economical answer to a problem we have all, in one manner or another, been forced to give attention to.

This paper would be both incomplete and unjust did it fail heartily to express the obligations of the writer to the Union Foundry Company, of Chicago, the contractors for the construction of the building, to whose engineer, Mr. Morava, and architect, Mr. F. W. Barker, he is largely indebted for practical help in completing and successfully carrying out many important details of the structure, and in its subsequent erection.

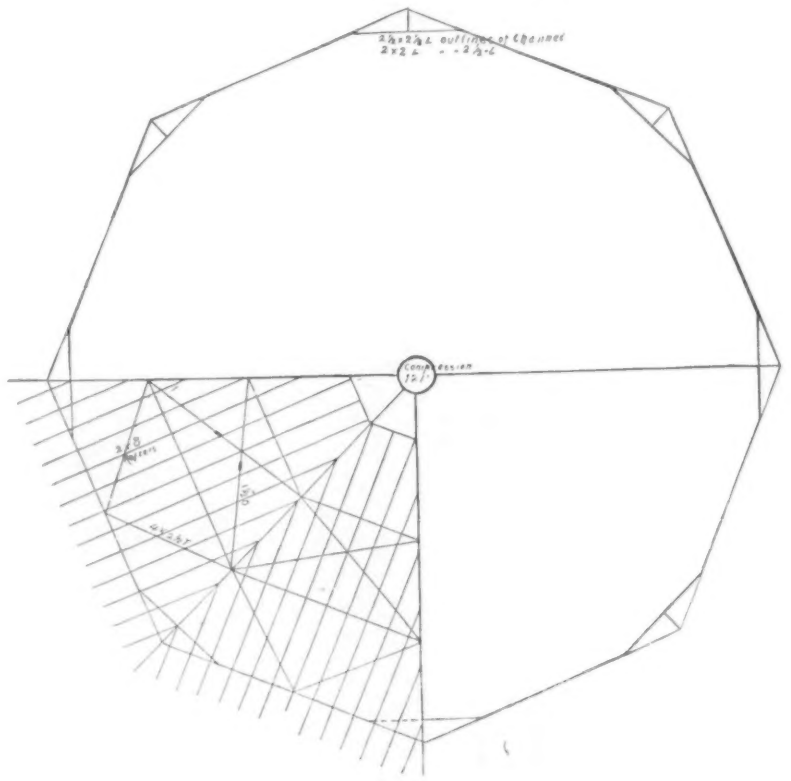

Fig. 2.

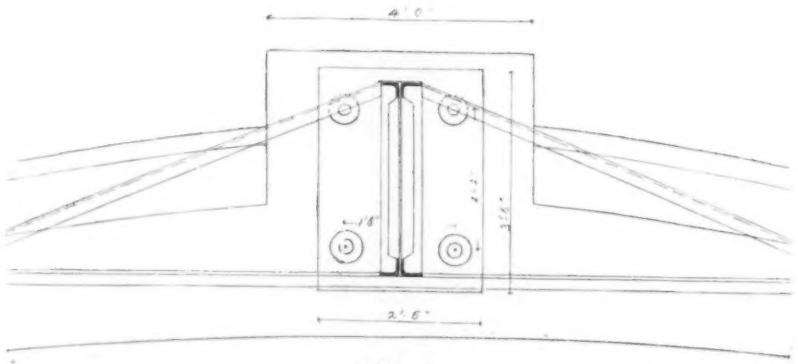

Fig. 3.

Discussion.

Capt. White—I omitted to state in my paper that the inner face of the upright girder carries an ordinary T-rail extending from the top to the bottom of the girder, forming a guide rail for the holder wheels.

Mr. Greenough—I suppose you cannot get around that rail and go between the different girders.

Capt. White—The diagram distributed to the members was made from the original plan, and does not show the subsequent alteration which provides for a passage around the holder, which passes through the girder. This cut in the girder is 5 feet high, and gives a clear way around the coping of tank. The house could not be made larger, for it now covers entire surface of the the lot.

Mr. Greenough—What is the size of the girder?

Capt. White—It is 3 feet wide at the base, and 7 inches wide on the face.

Mr. Harbison—I would like to ask if such an arrangement could be put over a holder now in use, and built with cylinder columns. If placed on the tank walls, how then could you get around it, in case of necessity, without going outside?

Capt. White—You would have to get between the holder and the column as it now exists. If there was not room to do that, then you would require doors between every other column.

Mr. Crafts—Have you seen the three brick gasholder houses in New Haven, Connecticut?

Capt. White—I have not.

Mr. Crafts—I was about to ask how the cost of yours compared with those. They are built of brick and covered with an iron roof. Everybody knows that a brick house is preferable to an iron one. At Connecticut they had to put in double sash in order to keep the cold out, and to keep the tanks from freezing. I do not see any advantage in the iron house at St. Paul over the brick houses in New Haven.

Capt. White—The only advantage, as between brick and iron, is the relative cost. This house can be erected cheaper than any house I have ever seen built.

Mr. Crafts—I think the New Haven houses are the most complete of their kind that I ever saw.

Capt. White—Your experience in that direction is, of course, very much superior to my own. I have not yet found a holder house built as cheaply as I can build this. I simply present it to the members as something that I felt we were all looking for—a method of covering our holders at a cost which would not be a bar to the construction of such a building. In my own experience, and with such observations as I have been able to make, I have not yet found a holder house that was as cheaply constructed as this. Of course, I cannot refer to those at New Haven, for I am not familiar with them.

Mr. Greenough—I do not know anything to prevent the filling in of the interstices between those girders with brickwork, if it is cheaper to do so. Of course, it would give much greater protection against the cold if the walls were built of brick, rather than of corrugated iron. Being built of corrugated iron I do not suppose they would protect the tank from freezing, although they would protect it from wind and storms.

Capt. White—I had in mind the very low temperature of St. Paul, and I

knew that I could heat the space between the holder and the outer covering without any difficulty, and so prevent the holder cups from freezing. But, of course, not having tried it, I cannot say what the result will be.

Mr. Greenough—It will be a matter of interest to the Association next year to know whether that can be done.

Capt. White—We know that a very little steam will keep a gasholder cup from freezing. If we simply succeed in protecting the holder from the wind and snow storms in that high latitude, we are willing to take the chance of keeping it from freezing. But my own judgment now is that it would be better to sheathe the whole holder house with wood under the iron, the same as arranged for the roof; and that plan has been adopted, and the iron plates put upon the wood sheathing. I think that makes a perfect house.

Mr. Greenough—I think that would add very much to the effectiveness of the house. The suggestion of ideas like this is exactly what this Association is intended for. It is desirable that we should have new matters of this kind presented to us, and then we can reflect upon them. It hardly gives a person time to make up his mind to the efficiency of a scheme like this, simply to have a drawing presented, and a paper read, and then have the matter passed over and something else taken up. The experience of everyone is of interest; and I may say that we have seven gasholders with buildings over them at Boston; but when we came to construct a holder 200 feet in diameter we made up our minds not to house it. A holder of that kind without a house, to be safe, must be near the gas works, so that the men can get readily at it; and it requires a great deal more care than when it is put under cover. I think that a scheme like this, which provides for economically covering a holder, is worthy our consideration. I have seen the drawings of a covered holder 200 feet in diameter in which the roof rests on a center pier; and then, instead of having guide frames all around the outside, the holder was worked on the pier which ran up in the center of it. The holder is then made very solid. I also think that the drawing which I saw showed a lining of felt on the inside of the building as a protection against cold. We made up our minds that that was too expensive, and that we would risk it without any covering. A scheme of this kind is of very marked value, and worthy the consideration of the Association.

Capt. White—The cost of housing the holders of the Chicago Consumers Gas Company was something frightful. I had gone into the housing of those holders without making close estimates, and I carried my directors along with me, upon general principles; but I was perfectly startled when I came to realize how much money was expended in the substantial structure erected. It is probable that it will be returned to them in the course of years, but that experience made me very much more anxious to find some simpler method of solving this problem.

Mr. Helme—I think that Capt. White, in his very clear and succint statement, has omitted to give us an idea of just what the difference is in cost between constructing a holder of this kind under cover, and constructing a holder of similar kind, but covering it in the way that has been usual up to this time.

Capt. White—The difference in the case under consideration would have been over $3,000—*i. e.*, between a brick house and that erected at St. Paul, figuring, of course, on the cost of brick at St. Paul. I, therefore, saved that sum on the St. Paul house.

Mr. Littlehales—I must say the cost of Captain White's house seems to be very reasonable indeed, in fact, cheap, for a house of that size. There is one point, however, on which I have grave doubts. In a cold climate like that of St. Paul, which is much like ours in Canada, I would be very much inclined to doubt the safety of that house. Over and over again in our northern latitudes I have known iron roofs to break because of the strains becoming so severe on some one point. For instance, when the temperature is down to 15° or 20° below zero, some of the outside frame will be subject to immense tensile strain; and if there are any steam pipes inside of the house there will be a very great difference. It has been a matter of surprise to many gas engineers to find wooden roofs over retort houses in Canada; and it often evokes smiles from some of our Southern friends when they come through Canada and see our retort houses covered with wood. Our experience teaches us the wisdom of using wooden roofs; and I should be inclined to doubt the stability of this structure of Captain White's. Nevertheless, it certainly has the merit of remarkable cheapness. We built one as nearly the same size as possible—90 feet in diameter—with a double lift 20 feet high; and that house cost us, apart from the tank, about $15,000. Capt. White's house is a little heavier than ours; but I take it that, in consideration of the greater expense of doing the work at St. Paul, it is a far cheaper piece of work than we turned out.

On motion of Mr. Greenough (seconded by Mr. Harbison), a vote of thanks was tendered to Captain White.

Mr. Arthur E. Boardman, of Macon, Ga., now read the following paper, entitled—

SUGGESTIONS UPON CANDLE POWER AND ILLUMINATION.

Mr. President and Gentlemen:—It was my desire and intention to have made some experiments during the past year upon the difficulty in reconciling candle power and illumination, and to have presented the results to you at this meeting.

Unfortunately I was prevented by sickness, lack of necessary apparatus, and press of more active duties, so that I have come before you with only a few suggestions upon this subject, which are offered in the hope that they may direct your observations and discussions toward this discrepancy.

My attention was first called to the disparity between the record of the photometer and the actual results in illuminating by an experiment made when I first took charge of a gas works, and when very energetic in striving to realize fame and fortune at a single bound by some grand discovery. A description of it may serve to make my meaning of the difference between candle power and illumination more clear, so I will relate it. I had, of course, noticed the effect upon the flame of the oil student lamp, produced by the contraction of the chimney, and I determined to apply this principle to the gas Argand. After testing my gas with the ordinary Argand and chimney, and finding it about 16-candle power, I removed the gas chimney and substituted that of a student lamp, leaving everything else as it was. Imagine my astonishment and delight when, on making the observation, I found that the gas was 22-candle power. Had anyone been near I should have exclaimed, "Eureka!" but being alone, I merely thought it, or words to that effect. The rest of the day my mind was filled with the methods to be pursued in having my discovery improved, patented, and properly advertised, and my fortune realized. Anxious to share my elation with the partner of my joys, I hastened home that evening with one of the student lamp chimneys. After tea I explained my grand discovery to my wife, and called upon her to witness the startling increase of brilliancy by simply substituting one chimney for the other. The effect indeed was great. We could easily look at and admire the rich warm flame of the Argand with straight chimney, but when the other was put on our eyes could hardly bear the direct rays from the brilliant point of light produced. Satisfied with this, we drew our chair and lounge before the fire, and on either side of the dazzling light, and prepared respectively to enjoy the evening in reading and sewing. Getting into a comfortable position on the lounge I opened my book and began to read. The printed characters, from some cause, were not as legible as usual, and I turned quickly to my better half, who was vainly trying to thread her needle, and asked if she had turned down the gas. She has not that excessive respect for me that my position at the gas works should command, and is capable of a practical joke at my expense when occasion offers. However, this time she had not tampered with the light, and was as much in the *dark* as I regarding the cause of the trouble. We concluded that our eyes were dazzled by looking directly at the flame, so we turned down the gas until we should become accustomed to the gloom, then turned it up again without looking directly at it, and tried the reading and sewing anew. The result was the same. I gazed around the room and upon the objects there to see if they, too, shared the depressing effect of this dazzling newcomer. Alas! the clock on the mantel seemed to have drawn a veil over its face; the statuette of Venus in the corner might have dropped her robe without impropriety; and the polished brass scuttle seemed to have come into intimate relation with the contents of the mercury cup on the gas fixture, so white and pale it looked. Everything pointed to a dismal failure, and seemed to say, "Beware of contaminating your gas by contact with even the chimney of an oil lamp!"

The straight chimney was reinstated; the warm, mellow light diffused itself throughout the room, and brightened up the despondent furniture. The needle was threaded, the book resumed, and nothing remained but the disappointment. Thinking the trouble might possibly be in the burner I tested it, at the photometer, with the two chimneys; but with the same results. There was always an increase of candle power, but a dscrease of illumination; and I may add, the experimenter was made a "sadder and a wiser man."

Since that memorable event many things have occurred which have strengthened my belief that the photometer is not entirely reliable as a light measurer, and more especially where the lights are of different kinds. It did very well so long as the light of flames having very nearly the same temperature were compared; but when it is used to compare the flame of a substance burning in the open air, with the light emitted from the voltaic, or even with that of the same substance under forced draught, I think the arc comparison unfair to the light of lower temperature. Light and heat are analogous, and one might as well expect a small rod of iron, heated to one thousand degrees, to warm a room equally with a large surface radiator heated to 212°, as expect a small speck of intense light to illumine a space equally with a large flame of much less intensity. The photometer seems to be more sensitive to intensity than to volume, and for this reason is not reliable as the arbiter of the character of light we should sell for the purposes to which it is generally put. The high-power burners, producing an intense light by

reason of the high temperature at which the gas is burned, and showing astonishing results as to candle-power per foot of gas consumed, are, in some degree, deceptive as to their power of illuminating space. Fortunately for them they also enlarge the dimensions of the light-giving flame while increasing its intensity, and, therefore, really increase the illuminating power, though not to the extent we are led to expect from the nominal increase in candle power. The arc light with its enormous—and if measured by the photometer it will much nearer approach the claimed two thousand than we wish to acknowledge—has not the illuminating power of the large Siemen burner claiming only five hundred-candle power. The incandescent light, showing actually sixteen-candle power by the photometer, has not the illuminating power of a ten-candle gas flame, and it is because of the extent or size of the exciting surface.

Examining the report of the Franklin Institute, as to the efficiency of the various incandescent lamps, I was struck with the fact that in those lamps having carbons with circular section the candle power was very nearly the same taken in every direction on a horizontal plane, thus indicating that the photometer took no cognizance of the light-giving surface exposed to it. That is, the candle power was the same when the plane of the loop was at right angles to the bar as when in the same plane. In the first instance the entire loop was exposed, but in the second one side of the loop must have been behind the other, and the illuminating power in that direction must have been less, though the candle power remained the same.

In a flat gas flame we know the illumination is less in the plane of the flame, although that is comparatively transparent. The photometer indicates this because the difference in surface exposed is many times greater, and the intensity of the two flames compared—the candle and gas—are more nearly equal; still the difference in candle power indicated is not commensurate with the actual difference in illuminating power.

It would be of great interest to us, and possibly of great value, to have at our command reliable data of photometric observations upon equal areas of the different flames and incandescent substances used for illuminating. Could a gas flame, for instance, be projected full size upon cross-section paper, with lines one-eighth of an inch apart, and each one-eighth of an inch area have its illuminating value determined with relation to the one-eighth of an inch of metal heated to a certain temperature, we would be able to arrive more nearly at its value as an illuminating agent by the sum of the values of each unit of surface. Other flames could, in like manner, be compared, as could also incandescent substances other than flames, and even the arc light itself. The future photometer may possibly be of this character, having, as the unit of light, that emitted by a certain area of metal heated to a certain temperature. As temperatures are difficult to maintain and ascertain, electricity may be called to our aid as a means of heating the standard metal, by passing a current of known and constant strength through a strip of the metal having a known and constant resistance.

The experiments of the British Lighthouse Board have, I think, demonstrated the fact that a light of great intensity and small area will not illuminate and penetrate a fog so well as one of less intensity and large area. As the atmosphere is always in a condition approximating more or less to fog, the small, intense lights will not illumine so large a space as the large ones of less intensity. The reason is obvious. Every particle of dust or vapor casts a shadow, and the smaller the surface of the light the longer that shadow, and the more likely it is to reach and overlap the shadow of the next particle; while the larger the light-giving surface the shorter these shadows, and the more easily does the light penetrate. Again, the large light illumines more of the surface of each particle, and is, therefore, better diffused by reflection from these surfaces, and the shadows are thereby made less intense.

The color of light used for illuminating space has much to do with its value, though the photometer may not indicate it. Yellow is called the most luminous of the rays of the spectrum, while the more of the blue we get the more dazzling the effect, but not the more luminous. The light which penetrates further through the atmosphere, and in greater quantity, is the red spectrum, the blue being arrested or reflected. The red of our sunsets shows the power of the red and yellow light in penetrating great depths of atmosphere, with dust and smoke in suspension, while the color of the sea indicates the portions arrested and reflected. This is doubtless due to the greater amplitude of the vibrations of the red and yellow light which causes them to overcome obstacles in their path that would be insurmountable to the quicker but less ponderous blue; for, though their rate of transmission is the same, their momentum, as it were, is greatly in favor of the red. Like the harmony of music pervading space, so is light; and as the shrill notes of the orchestra travel as fast as the deep boom of the bass viol, so blue light, due to higher temperature, travels as fast as the red; but the bass viol is heard far beyond the reach of the fife, and the red light penetrates where the blue has become exhausted.

Therefore would I suggest that we strive to increase the illuminating power of our gas light, rather than imitate the electric promoters in securing high candle power. Increase the size of our burner flames as well as their intensity, and do not sacrifice our yellow rays to secure their blue. We know that the gas flame, protected by a clear glass globe, is brighter and of greater candle power than the same flame protected by an opaline globe; yet is the latter preferred by the public whom we serve, even though it compels greater expense for additional gas. The reason, I think, lies in the larger exciting surface, for the entire globe becomes, as it were, incandescent, though of greatly reduced intensity; and also from the transmitted light being of more yellow tone. A yellow or amber globe of transparent glass will not answer so well, because, though the color may be all that is desired, the waves of light are not broken up and thereby so well diffused.

I fear that the present demand for high candle power, or rather intense lights, stimulated as it has been by the advertising devices of the electricians, has, in a measure, warped our better judgment, and that we are catering to a vitiated taste when we endeavor to light our interiors with few centers of intense light. I think we should strive in our lighting effects so to distribute our burners as to enable every object in the space illumined to be equally visible on every side without any areas of intense light or intense shadows. We are so constituted that our different sensations are closely related, and we must not do violence to one expecting to gratify another; hence we should be very careful how we disappoint that agreeable sensation of warmth and comfort, which always accompanies light, by substituting the cold and glaring for the warm and mellow.

Discussion.

Mr. Clark—I would like to ask Mr. Boardman if it is not by the amount of illumination that he gets the candle power. If the candle power is not simply a measure of the amount of illumination, and must therefore be commensurate with it?

Mr. Boardman—I think not, altogether. It seems to me that the photometer measures only the direct rays falling upon it, without relation to the diffusion which occurs from a large lighting surface reflected from other surfaces. The candle power, as measured by the photometer, is only a measure of the intensity of the wave proceeding in one direction; and while it is a correct comparison between two lights, as to the intensity, I think it is not a correct comparison between the powers of those two lights to illuminate the space in which they are situated. I do not exactly get your meaning, unless I have answered your question.

Mr. Clark—My meaning is about this: Light, as we know, proceeds from its source in all directions with equal intensity. We may take a certain section of light wave proceeding from any source, and measure it by comparison with a certain section of light wave from another and standard source; and it seems to me that that is an actual measurement of the luminous qualities of one light as compared with another. I cannot see how you can make a distinction between illumination and candle power, for that reason. Candle power is our recognized standard of illumination; and although the candle is not an exact standard, still it is the standard. At your disc you have a positive comparison between the amount of illumination that a candle gives and the amount of illumination that the gas gives; and that is called candle power. The system, it seems to me, affords good means of determining or measuring the illumination.

Mr. Littlehales—I think the point which Mr. Boardman raises can be very simply illustrated by a diagram. I think he is perfectly correct in the position assumed as regards the diffusive qualities of the two lights. We may illustrate it by a diagram in this way: We will suppose that an arc light having an area of a certain size, and a series of gas flames that will nearly equal that box in size (pointing to a box about ten inches cube). We may imagine a line of light starting from every point on the whole area of each; and it is very certain that, at a given point, you will get a greater number of light lines from the larger one than you will from the smaller. If you will try it by drawing it down to lines you will see what I mean. If you have from each little point lines drawn at every possible angle, as you proceed away those lines will diverge, and you have no point between from which new ones emanate; consequently the larger area from which they emanate will give you a larger number lines at any given point.

Mr. A. C. Humphreys—I quite agree with Mr. Boardman in regard to the distinction which he makes between volume and intensity. Nevertheless, I think the point which Mr. Clark makes is entirely correct. The photometer is a measurer of illumination at a certain point. A disc is there for that purpose, and we illuminate both sides of that disc. We do not want to mix up cause and effect. We have the effect right there, and we measure the illumination of that particular disc. I think the point which Mr. Clark made is well taken. The photometer is a measurer of illumination, and it measures it by putting in that disc at that particular point. I would ask Mr. Boardman, with regard to difference in the color of light, what sort of measurement he made, and how he found out about the difference in color.

Mr. Boardman—I will state, as I said at the outset, that I had no opportunity to make any direct tests; but the eye, it seems to me, is sufficiently sensitive to notice the difference in the color of the two lights. The point

which Mr. Clark makes is very correct. The candle power, as shown on the photometer, is a correct measure of the light emitted from those two points; but it is not a correct measure of the ability of those two lights to illumine space. That is my point; not that a single object placed between the two lights will not be illumined in direct proportion to the intensity of those lights, but that the space in which they are placed will be better illumined with the larger light—that the dust in the atmosphere will not have the effect of diminishing the light of larger area so much as it will the light of smaller area. Taking the intensity of the two lights as being the same—as indicating the same on the photometer—and your gas flame of three square inches area, giving almost the same as a very bright candle flame under a forced draught would perhaps give, you get a point of light giving a shadow equally distant between them; but you would find, when you came to use the light, that the light of larger surface would give you better results. I think it is due to the obstruction which always exists in our atmosphere. Could we measure these lights in space outside of atmospheric influences, and where there would be no reflection and no interference by dust particles, then the candle power as shown by the photometer would be very accurate; but where these things do exist I contend that the light with the larger surface is the better light for the purposes to which we apply light.

Mr. Greenough—It is very rarely, I think, that one has an opportunity of standing up and saying that he agrees with both parties to a controversy. Mr. Clark is unquestionably right, I think, in suggesting that the photometer is a proper measurer of light. On the other hand, I think Mr. Boardman is unquestionably right in the position he has taken—that you cannot measure the illuminating power of two gases by their relative light on the photometer. That I think is true. I do not understand as yet why it is so. I am sorry to say that it is some time since I studied physics; and I know that this question was not at that time brought up. It may be owing to the color; it may be in the carrying power of the different rays of which light is composed; it may be that the yellow rays carry further than the white rays; but it is unquestionably true that there is more light in a 16-candle power gas flame than there is in a 16-candle electric light. And I should maintain that there is as much power in a 20-candle power coal gas flame as there is in one from water gas which showed much higher upon the photometer.

Capt. White—I think that I am so very happily situated at present as to be able to throw some little light upon the varying capacities of the incandescent electric burner and the coal gas burner, both reckoned at 16 candles in their light-giving capacities. I happen to be the unfortunate, or fortunate, owner of gas works making coal gas, and also of an electric light plant in the same town. We have there some of our stores lighted with incandescent electric lights which we call 16 candles. Upon our photometer, the day we set them up they were 16 candles; but the deterioration from 16 candles to 12 candles is very rapid—almost precipitate. They seemed to hang at 12 candles for about a week or ten days; then they gradually descend to 7 or 8 candles, and remain there for the life of the lamp—which is variously computed at from 600 to 800 hours. The lamps we use are the Edison, and are guaranteed for 600 hours; sometimes they do not last six hours, but I have some old fogies which have been in use for nearly 2,000 hours. Upon the question of the diffusiveness of light, I may say that I have a store in Little Falls lighted with incandescent lamps, in which the lamps are nicely distributed, the woodwork is painted white, and there is every facility for securing the utmost duty of the "light of the future." Immediately adjoining that store is one lighted with coal gas of 16-candle power, and the gas is not nearly so well distributed; yet that store is better lighted than is the store supplied with incandescent lamps. I am gathering money from both sources, and can therefore speak in an unbiased way about both or either. I don't care which light a man has so long as he pays his bill, but remain an interested observer of the diffusiveness, lighting value, and cost of these two lights. I am probably also in a position to be able to say something from actual experience about the diffusiveness of coal gas and water gas in the same district. It is probably well known that I was one of the first of the regular gas engineers in this country to have anything to do with manufacturing and distributing water gas. I distributed it as water gas *per se*, and also mixed with coal gas in varying proportions. I have found this to be an absolute fact: Time and time again a gas that would measure upon my photometer over 20 candles, being made of one-third water gas and two-thirds coal gas, would not begin to diffuse and distribute the light in a room equal to 16-candle coal gas. In other words, I found that while my water gas would realize high illuminating power upon the photometer, it would not diffuse as well in actual use as the lower grade coal gas. It was intense, local, but not a diffusive light like coal gas. (Applause.) I feel that this is an Association of men who are interested in the business of gas making, and all should be anxious for the dissemination of facts. I have no prejudice either way in the question, for I am just as ready to build a water gas works, if called on, as I am to build a coal gas works; but here we should desire to know the truth. It is not fitting for this Association to tie itself to any one belief and say that a man must be a coal gas engineer in order to be a gas man. (Applause.) It is an absolute fact, and may be demonstrated as a fact every day under your own observation, that water gas does not possess, nor does the electric light possess, the diffusibility of a good, well-made coal gas. That is an absolute fact which you can fully demonstrate to your own satisfaction. I have tried the experiment with coal gas, and then have lit the same room with water gas, and with water gas and coal gas mixed; and I say it is absolutely the fact that the room was better lighted when it was illumined with the 16-candle coal gas than it was with 20-candle water and coal gas mixed.

Mr. Wood—I once had a trial with some chimneys that were made, supposing they were going to show a great improvement in illuminating. The man who made them brought them to me and asked that I would make a test of them on the photometer. I did so, and we obtained on the photometer test a 33 per cent. increase of light. Then we put them on some lamps to try them, but with them we could not get the light that we did from a plain chimney, and subsequently discovered that the fluting on the new chimney had such an effect on the photometer that it would nearly double the nominal light.

On motion of Mr. Lansden a vote of thanks was tendered to Mr. Boardman.

(To be continued.)

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Dec. 10, 1886.

The Board of Trade Returns.—The "Daily News" Gives Advice to Gas Consumers.—The Electric Light Gets Notorious.—Mr. C. C. Carpenter's Generator Furnaces.—A Big Bonfire.

The returns prepared by order of Parliament relating to all authorized gas undertakings in the United Kingdom, whether belonging to joint stock companies, to individuals, or to local authorities, for the year 1885, have lately been issued. This is the fifth year of the issue of these returns as an annual publication, and they now begin to indicate some approach to completeness, although there are several things which prevent the records from showing an exact return for the year ended Dec. 31st, 1885. Most of the local authorities make up their accounts, not to the end of each year, but to each 25th day of March, and therefore the returns relating to gas undertakings worked by local authorities who have availed themselves of the protection offered by Parliament, are made up for the year ended March 25th, 1886. Then in some cases the capital has been raised for gas and water works combined, and it is not possible to allocate the exact amount that has been applied for gas purposes. So the returns can only be considered as a fair approximation to a correct indication of gas affairs for the year 1885. These remarks do not apply to the quantity of coal carbonized, and the quantity of gas made and sold, also to the number of consumers and public lamps. The quantity of gas made is shown by the station meter, which is usually kept in accurate working order, and, therefore, this return will be correct to a fraction. The gas sold includes not only the aggregate indications of the consumers' meters, but also various quantities sold by contract, without meters, for public lighting and other purposes. Gas engineers naturally like to show as small a leakage account as possible, and, therefore, are not likely to underestimate the bulk in the case of gas that is sold without measurement; and so the returns for gas sold may be regarded as certainly not under the mark.

It is not possible to deal in this letter with the whole of the varied information included under the 24 headings comprised in the returns. So I may remark in passing, that they are published at a low price—about half a dollar for the two, and are readily obtainable by those who may desire to examine this interesting subject in detail. The summary shows that there is in the United Kingdom about 260 million dollars actually invested in the gas industry, and that the plant represented by that sum turns out nearly 85 thousand millions cubic feet of gas per annum, requiring for its production alone 8¼ millions tons of coal. And this quantity of gas is distributed, by means of 19,000 miles of mains, to 2,100,000 consumers, and more than 400,000 public lamps.

But the most interesting feature of the papers is the comparative tables, in which the totals for the last four years are given. Without exception all the items show an increase year by year. It is not a large one, but it is steady and well sustained. As an example, the quantity of gas made may be cited, which in the year 1882 amounted to just over 73 thousand million cubic feet, but which, as above remarked, now approaches to 85 thousand million. This is satisfactory as showing the steady increase in our business, which is due not so much to the increase of consumers as to the introduction of stoves and other appliances, which have had the effect of increasing the average consumption per consumer. The number of consumers in 1882 was about 1,970,000, and this compared with the figure above given for 1885 shows an increase of 6 to 7 per cent. But the increase in consumption of gas is more

than double, being 15 or 16 per cent. It may be well to remark before leaving this subject that although nearly all gas undertakings making more than, let us say, 5,000,000 cubic feet per annum, apply to Parliament for a special act, and so become authorized gas undertakings, there are a large number of smaller ones scattered abroad throughout the country whose income is not large enough to warrant the legal and other expenses connected with the obtaining of an act of Parliament. In Scotland, and especially in Ireland, there are several gas companies whose operations considerably exceed the above limit who have not thought it necessary to acquire Parliamentary protection. Where all the large gas consumers are shareholders in the undertaking, for instance, there is no fear of competition coming in; and if any attempt is made to force a high price upon small customers, the undertaking suffers by reason of the restricted demand. So there are often circumstances which bind together the interests of all parties concerned, and thus render legal enactments unnecessary. Therefore the actual quantity of gas manufactured in the United Kingdom is considerably more than that shown by the aggregate of the authorized returns as above mentioned.

Having more than once had occasion to remark upon the nonsense on the subject of gas supply and consumption that has appeared in our daily press, I have pleasure in calling attention to a really good common sense article on the subject of "Economical Gas Burning," that came out in a recent issue of one of our leading newspapers, the *Daily News*. It commences by remarking that now is the time, when the dark and cold weather is coming on, to think about economical gas consumption. But it usually happens that the gas bill for the quarter ending Sept. 30th is a very light one, and is paid without a thought; so that matters go on unheeded until the account for the quarter ended December 31st is presented, which will be some time in January. This, of course, as it covers the darkest days, is a heavy one, and the result is that the consumer begins to talk about economizing gas at a time when the heaviest consumption is over and gone. The writer goes on to remark that though unexplainably high gas bills are sometimes met with, such cases are rare, and that a little intelligent management will materially affect the cost of gas in almost any household; and when bills are abnormally high it will generally be found that the phenomena is due to a want of intelligent supervision, or of ignorance as to the best way of obtaining a maximum of light with a minimum of gas. The principles necessary for economical consumption of gas, such as the effect of pressure, the necessity for burners of suitable size and make, proper supply of air, etc., are set forth in plain language. And the consumer is recommended to select good burners, and see to the regulation of the pressure. He is also very pertinently reminded that "the economy secured by the best of appliances may easily be neutralized by an extravagant employment of gas lights in out-of-the-way and unfrequented corners of a house." It is remarked that consumers esteem a fall of 2½ or 5 per cent. in the price of gas a matter of great importance, and yet they often defraud themselves of 10 to 20 per cent. of the value of the gas by the use of unsuitable fittings and burners. The article is so cleverly and pithily written that an abstract fails to do it justice. It must be read in its entirety in order to appreciate all its good points.

The electric light is gaining a certain degree of notoriety, although the same may not take the direction desired by its promoters. The chairman of a suburban gas company remarked, at a meeting held some years ago, when the extravagant claims in behalf of the new light were in full bloom, that it had been asserted that the electric light was like the sun, and he would admit that such was the case. For the sun was frequently obscured by clouds, and it set and went out every night; and the electric light was also frequently obscured, and set and went out. The truth of the simile is still maintained. Only a few days since the occupants of the reading room at the British Museum had an unpleasant illustration. This is a large room with accommodation for a considerable number of readers, in connection with the well-known library, and as it is open free, it is usually well patronized. I have heard that a considerable number of *original* inventions first came to light in this room, but cannot say if such is the case. On the evening in question the librarian suddenly called for the prompt return of all books, as the electric light was going out, at the same time advising the readers to follow its example. As no gas or candles were at hand, and the reading desks and chairs offer some impediment to an easy exit in the dark, his advice was promptly acted upon. Evidently the electric light cannot be trusted to stand by itself yet. In another case, a well-known concert hall was lighted by gas and electricity together, and the latter suddenly went off duty in the middle of the evening. Fortunately the gas is always on hand to take the place of its erratic rival when necessary. An amusing case happened at a town in France recently. A large theater had been fitted up with electric lights, to the displacement of gas, which had formerly been used. As usual, the gas fittings had been left intact ready for any emergency, but the manager of the gas works, finding that the uncertainty of the demand would cause him some inconvenience, as he would never know whether the theater would be lighted by gas or not, sent down *sub rosa*, and introduced a short length of small pipe on the supply service. For some nights this was unsuspected, as sufficient gas passed to keep up the supply all over the house when the lights were turned down low. But one evening, in the middle of the performance, the electric light failed *in toto*, and a rush was made to turn on the gas. This was duly done, but little more than a glimmer could be obtained, so a messenger was promptly despatched to the gas works to ask that more gas might be turned on. The discomfited proprietor of the theater received a message in reply to the effect that the gas works people had only sufficient gas for their regular customers; so there was nothing to do but to bring the entertainment to a premature close.

Mr. C. C. Carpenter, of the Vauxhall Gas Works, London, recently read a paper, at the meeting of the Southern District Association of Gas Managers, which affords some valuable information on the subject of gaseous fuel, and which has given rise to an animated discussion in the columns of the *Gas Journal*. Without going into theoretical questions, Mr. Carpenter has given plainly the practical results that he is able to obtain with different kinds of furnaces, and then proceeds to describe an arrangement which he has found to give results as good as any he has yet tried. This new arrangement possesses the important feature that one generator is made to supply gaseous fuel to four separate settings of retorts. The settings are placed on arches as usual in a stage retort house, and the furnace or producer occupies one of these arches, the remainder being left void. So many different views exist upon the subject of generators and regenerators that it requires no inconsiderable amount of courage to set forth any new views upon it, on account of the vast amount of critic sm that is sure to be aroused thereby. Although Mr. Carpenter has brought out some hostile remarks, there is generally an agreement that he has made an important advance, not only as regards the heating of retorts, but also in respect to the general application of gaseous fuel.

There has been a big bonfire at one of the Birmingham Gas Works, where a heap of coke 100 yards long by 60 yards wide, and rising from 30 to 60 feet in height, got well alight by some means or other, probably in consequence of carelessness on the part of the stokers in throwing hot coke upon the heap. Immediately on discovery steps were taken to extinguish the fire by means of water and removing the coke, but the combustion continued for nearly a week, it being at last found necessary to call in the fire brigade, who set to work with half a dozen sets of hose at various points. The heat, sulphur and clouds of steam produced by the application of water naturally created great excitement in the neighborhood of the works.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Col. Fred. S. Benson to Take a Trip to Europe.—That clever gas man and gallant soldier—Colonel Fred. Benson—who presides with such success over the manufacturing department of the best managed gas company—the Nassau—in the City of Churches, will in a few days entrust his manly spirit and portly frame to the care of one of the ocean greyhounds that will bear him on to old England. Col. Fred. is commissioned by the Nassau folks to examine into the theoretical details and to inspect the practical working of the various forms of regenerati:e furnace and improved bench construction now in use in Great Britain and on the Continent. May old ocean remember the virtues of mildness during the hours that the voyager will tempt the briny deep, and may the terrors of *mal de mer* never beset him.

One Day's Sendout from the Philadelphia Gas Works.—For the 24 hours ended Monday, December 20th, the quantity of gas sent out from the Philadelphia works measured, in round numbers, 13,269,000 cubic feet. The heaviest consumption in 1885 occurred on December 14th, when the footings showed a delivery of 13,021,000 cubic feet. No wonder private enterprise casts longing eyes at the Trust's business.

Batavia (Ohio) Would Like a Gas Works.—Batavia seems in a fair way to have a gas works pretty soon, at least Mr. J. O. F. Tatman, a Batavia merchant, says so. He proposes to purchase the plot known as the Jamieson property, which is located on Main street, as a site for the plant. Batavia is the capital of Clermont county, is on the east fork of the Little Miami river, and is 98 miles southwest of Columbus. Population about 3,000.

Named as Superintendent.—Mr. H. Porter has been appointed to the Superintendency of the Hudson (N. Y.) Gas Company's plant. Mr. E. Gifford, Jr., formerly acted as Treasurer, Secretary, and Superintendent of the Company, and we expect, like the experience of many other gas companies, the details of the three departments proved too onerous at last for one man's care. Mr. Porter has been in the employ of the Hudson Company for some years, and it is greatly to the credit of the proprietors that his fidelity to them is now rewarded. Mugwumpism, if Mr. Dana of the *Sun* will pardon us for the seeming breach of copyright committed, of the Hudson type is to be commended; and, as a rule, proprietors of gas works are mugwumps in so far as the latter means the retention or promotion in

their service of one who has served them faithfully and well. Not that we mean to intimate that Mr. Dana does not follow a similar rule in the *Sun* establishment, within which everyone and everything—not even excepting the cat—is treated in accordance with the mandate, "*Fiat justitia, ruat coelum!*"

A Word or Two from Geneva, N. Y.—Geneva, N. Y., famed for years for its beauty, rests as placidly and contentedly as ever on the border of Senaca Lake; but the progress of time has brought other changes, or those which mark the development and growth of a busy mart, and its people are duly and properly thankful for the multiplicity of signs which betoken the conquering tread of commerce. Perhaps Geneva's gas men are about as thankful as any other class of business devotees who reside within that city's classic precincts, for increasing commerce demands more light in order that commercial wares may be properly displayed, etc. Now, it is not so many years ago when the plant of the Geneva Gas Light Company, which consisted of one bench of small threes, running at irregular intervals in the manufacture of a wood gas subsequently enriched with naphtha, was ample enough to satisfactorily supply the quantity and quality of illumination demanded by the gas consumers of the place. The "bed of threes" of ancient times, however, had to give place to two benches of three clay retorts each, and coal was called upon to supplant the wood and naphtha material of the ante bellum days. The new equipment answered passably (or less) well until the season of 1885, but finally the management was compelled to admit that Superintendent S. S. Graves' demand for increased facilities could be no longer staved off. As a consequence he was empowered to go ahead with his plans, and the completion of these in time to meet the winter output of 1886-7 cut short his summer vacation—a privation most willingly submitted. The result of the summer campaign may be thus summed up: Two benches of fours were installed; a new exhauster put in; purifying capacity enlarged; and those other minor items, whose aggregate goes so far toward "making things run easy," were attended to. Like a prudent commander, having arranged everything needful for future possible contingencies, Supt. Graves determined to make a bold attack on the enemy's front—enemy meaning those who were partial to kerosene oil—and, having convinced his directors of the "powerfulness" of that particular sort of ammunition, swooped down upon them—the enemy—with the battle-cry of lower "charges" for gas. The usual result followed, which is that capitulation after capitulation was announced, and the directors of the company wondered and chorused, "Why did we not charge less before?" In fact, we might add on our account that the present rate ($2.50 per thousand cubic feet, former rate $3) appears to be rather high, and will in the near future amply stand a further cut. However, and since we are told, "All things come to those who wait," perhaps Supt. Graves' retort house figures for the dark days of current winter season, when placed alongside of like calculations concealed by the ghost of the past, will unfold a tale tending to convince his employers that, in the gas business anyway, money comes soonest to those who act quickly in the matter of adjusting their rates to a schedule based on the principle of enunciating to their consumers that a tariff for fair revenue only is the object in view. Still, the Geneva gas men have made a start, which is the prime reason that leads us to think they will be in at the finish, ready to repeat a "run" certain to end profitably.

A Sample of English Gas Rates.—Gas consumers in this country, particularly when those resident in the smaller towns "rise in their might" to confound the proprietors of the local gas undertaking, use as their first, middle, and final knock-down argument the assertion that gas prices in England are by far lower than those charged in similar places in the United States. This, like the rest of their "clinchers," is wide of the mark, in proof whereof we submit the following important concession lately promulgated by a Mr. Geo. Weller, who, we presume, from the tenor of the announcement, is owner of the St. Ives Gas Light Company. There is some doubt in this case whether St. Ives, of Cornwall, near Penzance, or the place of same name, on the Ouse river, near Huntingdon, is referred to. If the former, a population close on to 7,000 is supplied; but if the latter, the lighting needs of some 3,300 people is catered to. However, we incline to the view that the Cornwall district is the one in which Mr. Weller operates, and from the tables furnished in Hastings' directory of English gas companies, we find the capital stock of that Company is put at £10,000. The reader can draw his own deductions from the card published by Mr. Weller, which reads: "I beg to inform you that I have just made a cheap rate for gas used in this town for cooking and heating—viz., 5s. ($1.25) per thousand cubic feet, for which a separate meter must be provided. Gas used for lighting is 6s. 8d. ($1.66) per thousand cubic feet, which price has been charged for many years. You will, therefore, see that I have made a good reduction, and if I am supported in this by the consumers generally—so as to increase the consumption—I am prepared to make a further substantial reduction in price, but to do this I must have a larger consumption." We believe that meter rent is also charged; and if so we fail to note why many of the gas companies in the United States similarly situated, in respect of facilities for receiving and purchasing supplies, cost of same, etc., to Mr. Weller's Cornwall gas undertaking, are not doing much better in the matter of their charges to consumers than is the case with him. Again, it may be well to understand that the illuminating power of the Cornwall product probably does not exceed 15 candles.

At Rest.—We chronicle, with sorrow, the demise of Mr. Theodore B. Stephens, who for years had been the business manager of the Tarrytown (N. Y.) Gas Light Company. The sad event occured on Tuesday, December 21st, 1886, and interment of the remains was made from the Washington street Methodist Episcopal Church, Tarrytown, on the following Friday. Having known the deceased for many years, we can say from that knowledge that an upright man and faithful friend has been taken from us.

Breckenridge Cannel Goes to Liverpool.—A despatch from Messrs. Perkins & Co., dated December 23d, 1886, informs us that the steamer Cairn Marth had just been chartered to carry 2,000 tons of Kentucky's famous cannel from New Orleans, La., to Liverpool, England. The agreed-upon terms of charter placed the freight consideration at 25 shillings per ton, and the cargo awaits the vessel at New Orleans. Our eyes! Think of sending American cannel to England—a sort of Christmas offering, as it were.

To Pipe Natural Gas to St. Louis, Mo.—A line from St. Louis informs us that a project is on foot to supply natural gas to the St. Louis mill owners and foundrymen, the scheme being to pipe the gas from Edwardsville, Ill., a point about 30 miles distant from St. Louis. It is said that the pressure at mouth of wells from which the supply is to be derived equals 300 pounds to the square inch, and that the volume is sufficient to ensure a plentiful supply. The expense of the pipe line has been raised by subscription, from various St. Louis manufacturers, in amounts ranging between $50 and $1,000. Some of the contributors are not very enthusiastic as to ultimate success, while others are confident about it. The upshot will be awaited with interest; but if the facts, in the matter of pressure and volume, have not been overstated the scheme ought to equal the expectations of the most sanguine of its projectors.

A Resolution with an "If."—The Greenfield (Mass.) Town Council evidently wants electricity, but if the following is a fair transcript of the resolution passed by that progressive body on date of Dec. 20th, the Greenfielders are still a trifle doubtful about the cost. The resolution in substance is said to have been this: "*Resolved*, That a contract be entered into with a responsible company to light the city by electricity, until April 1st, 1890, whenever better lighting can be secured at no greater cost than that paid for the present gas service." Somewhat misty, we hear said, and truthfully. According to our information the present number of public lamps in Greenfield does not exceed 60.

A Letter from a Washington Territory Gas Man.—Mr. Robert Bruce, Secretary of the Olympia Gas Company, under date of December 17, 1886, forwarded the following quaint letter: "Mr. Editor—The city of Olympia is located on the headwaters of Puget Sound, Wash. Ter., and is a really beautiful place, albeit it possesses a population of considerably under 3,000 souls. You may judge as to its climate when I say that at time of writing the grass is green and growing flowers are plentiful. We have a 'duck pond' close by, some hundreds of miles in circumference, which affords feeding quarters and a native element for unlimited numbers of wild fowl and edible fish of the choicest varieties; and the timber that lines its banks grows to such a height that one has to look twice ere he discovers the foliage at its top. As for fruits and vegetables, I refer you to some of the samples contributed from here to the late New Orleans Exhibition, amongst which was a specimen of a wild gooseberry bush—the inevitable bush so dear to the hearts of those who boast of the glories of California vegetation—that had reached a height of 22 feet! Despite all these crowning advantages, the great drawback to the material and rapid advance of Olympia's prosperity is her stretch of mud flats. One mile from her wharves the greatest ship that ever was built could ride at anchor in one of the finest harbors in the world; but that fatal mile does all the mischief. At high tide there is a depth of but 12 feet of water at the city's wharves; yet there is likelihood all this will be changed, for the city authorities have entered into a contract which calls for the excavation of a fairly wide channel connection to deep water. Some work has been done on this contract, and while the same was in progress an average distance of 110 feet per diem was made. Owing to one cause or another the prosecution of the task was deferred to the spring of '87. With a channel to deep water, if Eastern capitalists cannot perceive an opening for judicious and profitable investment of money, then they must be nothing short of blind. Anyone may easily post himself as to the natural resources of our Territory, and in the rush sure to come it might be well to remember that the first on hand will have the 'pick of the basket.' There is some talk about the U. P. Rail-

road making connection here; and they had better come while the field is open. Now as to the local Gas Company. We are barely paying expenses at present, for times are extremely dull just now. The Company's plant is in pretty good shape, and is valued at $50,000. The list of officers comprises A. A. Phillips, President; Alex. Farquhar, Treasurer, the undersigned being Manager and Secretary. In order to encourage a more liberal use of gas we, on November 1, 1885, reduced selling rates from $4 to $3.50 per thousand cubic feet; again, a twelvemonth afterward, the price was reduced to $3, and I can truthfully say that every effort was made to please our people. However, all the encouragement we have received thus far is a total of 70 private consumers, and a contract with the city for 13 public lamps. We are not discouraged, despite the lack of recompense so far obtained, and are far from disposed to give up the fight."

Let us hope that the channel will soon be an accomplished fact, and that the Olympia gas men will speedily receive the recognition due their pluck.

Gas for Christmas Day.—The proprietors of the Sanford gas works expected to be able to supply gas on Christmas day. A nice sort of present.

Gas Competition at Findlay, Ohio.—The Cleveland *Leader* says that since the establishment of the city gas works at Findlay the old Findlay Gas Light Company has reduced the price of gas (natural) to 25 cents per month per stove, and will furnish gas to the churches free. Last winter, it is said, the price was $1.50 per stove. The city first reduced to 50 cents per stove, and the old company followed with the present cut.

Gas for the Street Lamps of Kankakee, Ills.—Two years ago the Sun Vapor Light Company, of Canton, Ohio, secured the contract for lighting the public lamps of Kankakee, Ills., and although it is said they performed the work in accordance with their agreement, the residents did not fancy the general results secured. Last December the contract expired, and hereafter the Kankakee Gas Company will do the work. The Sun Company received $15 per post per annum for the superseded gasoline lamps, but the Kankakee gas folks have now agreed to supply gas light at an annual charge of $14.50 per post, they to light and extinguish. A moon table is followed, of course. Something less than 60 gas lamps are located on the Company's mains, and recourse must still be had to the festive gasoline in situations not yet reached—to borrow a phrase from the language of that great amateur gas engineer, who strutted his brief but burning hour, aglow with youth, beauty and innocence, before the Senate Committee that investigated the gas supply etc., of New York city, Mr. Bottsford—by the arteries (gas pipes they are sometimes called) of the gas men. The oil lamps number 70, and will cost $12.50 per annum each.

The Cincinnati Gas Ordinance Passed.—At a meeting of the Cincinnati (O.) City Council, held December 17th, the ordinance recommended by joint committee (noted in our last issue), by which the Cincinnati Gas Company is instructed not to charge over $1.25 per thousand cubic feet for gas supplied to its customers, was endorsed by a vote of 33 for to 10 against. The ordinance is to remain in force for ten years.

Public Lighting at Burlington, Iowa.—The gas committee of the Burlington City Council advertises for bids for lighting that city's streets. The Burlington contract is made from year to year.

The Edison Company, of Aurora, Ills.—At a meeting for organization of the Aurora Edison Light Company, Mr. F. O. White was chosen president; S. J. Ricker, vice-president; A. M. Brown, secretary and treasurer. The aforementioned, and Messrs. E. H. Louderback, F. S. Gorton, T. Phillips and J. N. Clark, comprise the directors. At the meeting subscription books were opened, and the public were invited to take chances on the future of the shares.

A Gas Company's Water Bill.—The Chicago (Ills.) Gas Light and Coke Company had some trouble with the municipality in regard to the payment of the water tax bill, handed in by the latter, for the Company's water supply for the six months ended November 29th. According to the statement rendered it appears the Company used 2,520,481 gallons water in the six months, and the charge therefor was based on a tariff of eight cents per thousand gallons, or a total of $204. The Company refused to settle on the proposed basis, and showed that last year water commissioner Cregeir had previously ruled that six cents was a sufficient charge. On proof of that statement the Company submitted its receipted water tax bill, for the six months ended April 1st, 1886, which showed that during the specified period 2,901,723 gallons of water were consumed, and but $174 had been paid therefor. The Company's case was so clearly proved that the present water commissioner, Mr. Purdy, decided the city could only charge at the rate of six cents, as formerly. Of course, either rate cannot be looked upon as excessive, and the actual money difference involved was small, but right is right. Brother Watkins, anyhow, never did like to permit the Lake City authorities to get the better of him; and, come to think of it, they haven't much to brag over in that respect in so far as the record goes.

A Company that Proposes to Have Many Irons in the Fire.—Early last December Messrs. J. H. Howe, H. B. Hinsdale, and E. Simmons filed articles incorporating the American Water Supply Company, of Kenosha, Wis. The incorporators propose "to furnish gas, electric light, and power to the public." 'Tis a bad thing to bite off more than the molars, incisors, etc., can comfortably handle. The "men at the helm" have fixed the capital stock at $90,000.

More Sport for Chicago, Ills.—Messrs. G. N. Ackley, B. F. Weber and G. H. Carver have placed themselves on record as the legal progenitors of the Cook County Mutual Gas Company, of Chicago, and the aforesaid declare their intention that such corporation is a necessary adjunct, or one without which the people of Cook County cannot successfully subsist. Subsistence in this case meaning a supply of illuminating gas for lighting, heating and power purposes. The incorporators seem to believe that a capitalization of $100,000 will be sufficient for the end in view. Others who have prospected in that locality were more ambitious in their announcement of capital amounts; but an equality of fate seems to have been the portion of those who sought contest or conflict with a man who always had the courage of his convictions, and the hardihood to express them—we refer, if the figure was not already made plain, to Mr. Forstall.

Socorro (New Mexico) Wants a Gas Company.—Henry Lockhart, Chairman of the Water and Gas Committee of Socorro, advertises that the "City Council will receive sealed proposals for the gas franchise of the city of Socorro. All bids must specify the length of time desired for the franchise to run, the charges for gas to private consumers, and the charges to the city for street lighting, as well as other necessary matters of detail. The party receiving the award will be required to give a good and sufficient bond, in the sum of $5,000, to the city of Socorro for the completion of the works within one year. Bids will be received until Monday, January 10th, 1887." Socorro is the capital of a similarly-named county in New Mexico, and is on the west bank of the Rio Grande, at a point about 80 miles south of Albuquerque. From the latest data at hand the population of the place does not exceed 5,000 souls. Flouring mills and silver mines afford the principal industrial occupation of the people. It is a thriving place.

New Gas Coal Company.—Pittsburgh capitalists have created a new company for the mining of gas coal. The new corporate enterprise bears the name of the Shaner Gas Coal Company, and is capitalized in $250,000. Mining operations will be started on a vein about one-half mile distant from Guffey's station—the latter is on the old Pittsburgh & Connellsville Railroad, 24 miles southeast of Pittsburgh. Fifty double houses will be put up for the miners, and the Baltimore and Ohio people will put down a track to connect the mine with Guffey's station.

Election of Officers.—At the annual election of the Columbia (Pa.) Gas Company, Messrs. H. M. North, J. H. Black, H. F. Bruner, C. E. Graybill, J. A. Myers and M. S. Shuman were selected as a board of managers. Mr. Shuman is the only new member, he having been chosen in place of the late Samuel Truscott. Mr. Samuel Shoch was re-elected President.

Aurora (Ills.) Has an Electric Lighting Plant.—It is reported that Aurora's (not the one who so mightily pleased the fancy of the artist) electric lighting plant costs the taxpayers about $5,000 per annum, and in return therefor 72 arcs (low power) do duty as illuminants.

A Sad Blow.—It gives us sorrow to chronicle the death of Mrs. Alice W. Slater, the late wife of Mr. A. B. Slater, Jr., and daughter-in-law of Mr. A. B. Slater, of the Providence Gas Light Company, who departed this life on December 22. Deceased, who was but in her 23d year, gave abundant promise of a glorious womanhood, yet it was not to be, after all. The fraternity will sympathize deeply with the stricken husband and his sorrowing relatives.

Notes from the West.

By Retort.

December 24th, 1886.

With the closing of the year one naturally turns a retrospective glance to sum up the present condition of his business in contrast with the condition of the same one year ago; and in all lines of business the beginning of a new year calls for a serious and impartial survey of the past, as well as a renewal of effort for the future. Undoubtedly no other year in the history of gas lighting has encircled so much of important history as that of 1886. The year stands without parallel in activity, and is unapproached in the matter of progress. In fact, as great progress has been made in some directions as

had been made in a decade before, and, taken all in all, it was without doubt a thoroughly remarkable year. No business that is freely advertised can remain dormant, and no business has been more thoroughly advertised in many ways during the year than that of ours.

The discovery and development of natural gas have been of such vast importance as to not only stimulate its immediate locality, but the influence has been felt all over our broad land. It is an educator, superior to all others, in the matter of teaching the use of gas for fuel and mechanical purposes, and will do continued good in that direction. The simple fact that all the people of the town or city of ——— perform their heating and cooking with gaseous fuel is a convincing argument that, the cost being satisfactory, the same can be as successfully done elsewhere; and gas companies now have ten inquiries regarding gas stoves where they had but one the season before. Of course, the reductions in price, so nearly universal, acted as the principal promoter of the sale of gas as a fuel; but unquestionsbly next in importance to that factor has been the intelligence disseminated through the press and otherwise in connection with the natural product, as to the fact of its economy and cleanliness, not to speak of its labor-saving features. When the public generally learns the true proportion of the calorific properties as thoroughly as it now knows the difference in cost per thousand feet between natural and artificial gas, gas stoves will be in still greater demand.

Another wonderful stimulus, and equally valuable advertiser of gas interests, is the electric light. This light has pushed its way into prominence with wonderful rapidity during the year, and has been the means of infusing new life and activity into many a gas company's management, and, in equal measure, promoted gas sales. The electric light, upon its introduction into a community, enjoys unusually favorable facilities for business in its role of a competitor to some so-called monopoly of long standing, and usually plays its cards with tact and skill; but while it picks up much of the valuable business of its competitor, yet it opens so much new business for its seeming rival (the gas company) that its long dreaded advent is apt to be considered with too little caution or wisdom. The important phase of the electric light question is not so much what it now is as what it is to be. It is proverbially difficult to introduce into our retort house improvements of a labor-saving character, and we wonder at the clannish, narrow views of our stokers; but are we not, as gas managers, prone to consider in much the same way the advent of the electric light as a competitor? The question whether it is best for gas companies to operate a combined plant of electric and gas lighting is an alarmingly unsettled one, and it weakens one's faith in those we regard as men of pronounced ability in gas matters to hear them at one time poohpoohing the value and stability of a light, and within a twelvemonth as strongly advocating its adoption. It is very true that, in large measure, these questions must arise and be duly considered under the surrounding circumstances; but in matters of such general importance, and embracing so much financially, it does not seem possible to make sudden and complete conversions. I have often thought that in favorable circumstances, if there is a demand for electric or any other form of artificial illumination, the local gas company is the one to supply it; yet so very much is comprehended in the local surroundings that it is manifestly impossible for any rule to fit any given number of cases.

However this may be, the electric light has knocked at the councilmanic doors of most of our Western cities, and, as a rule, been admitted. A prominent gas man of liberal views and large information is reported to have said recently, "I think the future of electricity is more in the line of motive power than in that of light." And immediately upon the heels of this we read of the displacing of a 17-horse power gas engine by a 6-horse power electric motor, which latter receives its power through an ordinary wire from a light station. The further information is given that a 50-horse power dynamo will operate twelve 6-horse power motors, each capable of displacing an 18-horse power gas engine. In other words, the initial power being 50-horse, when subdivided and distributed through "So and So's motor" it gives out not 50 but 216-horse power. Evidently the fixed laws of mechanics and electricity are severely strained in the transmission. Admitting that nothing else in the annals of mechanical invention is more wonderful than the electric motor, nevertheless the motor is not yet discovered that can "lift itself by its suspenders," so to speak. At the same time, the electric motor, if not now, will unquestionably at no very distant time be a success, and will then be pushed for its share of the mechanical business.

Our weakest point in the competition with electricity is our street lighting. While we can do the public lighting far better and for much less money with gas, yet, with a hue and cry about public enterprise, a street lighting contract is awarded the electric promoters, and thus for a given number of years they are in possession. As a plain business proposition, they seek to attract business from our consumers in order to make their own business more profitable. Hence their energy and activity. After the plant is put in and their light turned on, it is a very small matter whether or not the illumination is as satisfactory as that from gas. It is pleasant to know that our illuminator is preferred; but the fact remains that they are furnishing the light and drawing the pay for the same. Now, it is obvious that if we desire to obtain and retain this business, and to put in a plant for the purpose, it should be done *before* the field is occupied.

A well-known gas man, who holds a controlling interest in several works, has adopted a policy of submitting three or more separate bids to his various constituencies, offering to light the city with gas alone, with electricity alone, or with gas and electricity combined; and his bids are laid before the authorities in ample time for him to erect his plant if the electric light is, in whole or in part, adopted. Why is not this, where it can be done, a wise idea?

In Favor of Plaintiff.—In the suit for preliminary injunction, brought by the Albo-Carbon Light Company, of Newark, N. J., in the United States Circuit Court for the Chicago (Ills.) district, to restrain Newman A. Ransom from infringing letters patent owned by plaintiff, Judge Gresham granted the prayer of the petitioner.

Correspondence

[The Journal is not responsible for the opinions expressed by correspondents.]

Mr. Emerson McMillin Refers to Mr. Frederic Egner's "Chapter on Practical Gas Making."

Columbus, Ohio, Dec. 21, 1886.

To the Editor American Gas Light Journal:

I have read Frederic Egner's communication, contained in the last issue of the Journal, with great interest; and if any gas engineer in this country may be properly styled an original investigator Mr. Egner is entitled to that distinction. His productions, as published from time to time in your Journal, always contain something fresh, and afford wholesome food for thought.

While the table of results obtained, given by him to us in his last paper, are instructive as a whole, I am most impressed by the last paragraph of his communication. He tells us it is possible to get 6 cubic feet of 22-candle gas out of a pound of coal that, treated in the old way, yields but 4.25 cubic feet of 14-candle gas. Indeed, he claims to have obtained even better results than these. That is a bold statement; but let skeptics pause and think before saying, "Impossible." I do not know how Mr. Egner obtained those results, and he does not tell us whether, from a commercial standpoint, it would *pay* to get such results. The writer had a system presented to his notice, a few mouths ago, by which the yield could be run up to 6.5 or 7 cubic feet of 20-candle gas, but it was done at the sacrifice of all the tar and ammonia water, and with a largely increased consumption of coke. I believe the claims of the inventor could be verified in practice, but when the claims were analyzed and reduced to cold figures, it became evident that the gain by the use of the process would not equal the loss.

I cannot say, of my own knowledge, that the claims of Mr. Egner can be demonstrated; but I do say, however, that it is possible, with Youghiogheny or Kanawha gas coal, to obtain as large a yield per pound of material, as large quantity per retort, and as high candle power, without the use of an enricher, as Mr. Egner obtains when using 4.8 gallons of oil per ton of coal. Just what temperature of retorts will produce these results, and how to keep the heats at that point, I am not yet prepared to say. That it is possible sometimes to increase the yield, and at the same time increase the candle power, may be theoretically demonstrated in the following manner: $C_4 H_4$ (one volume of ethylene) broken up, equals $C_2 H_2$ (one volume of acetylene), plus H_2 (one volume of hydrogen). Here we have two volumes where but one existed, and the acetylene is said to have four times the lighting power of ethylene. Again, at extremely high heats the benzol of the tar will be decomposed, yielding hydrogen, and probably acetylene. This adds greatly to the quantity, and, of course, some to the quality; for had the benzol not been decomposed it would have been absorbed and removed from the gas by the tar.

Again, we may get acetylene with increased total volume from the decomposition of marsh gas, thus: $2C\ H_4$ equals $C_2 H_2$ plus $4H_2$; or, beginning with two volumes we end with five. Ordinarily by increasing our heats we increase the volume, but decrease illuminating power by forming hydrocarbon compounds that will not remain gaseous. For instance, marsh gas may be broken up thus: $10C\ H_4$ equals $C10\ H_8$, plus $16\ H_2$; but this gives us naphthaline, which had best not be produced. Of course, we cannot do more than surmise whether these combinations occur direct, or whether they pass through intermediate stages, forming complex compounds, probably of which we have no knowledge. All this, however, is mere theorizing; but the fact remains that 5.25 to 5.50 cubic feet of gas can be made, under proper conditions, out of Youghiogheny or Kanawha gas coal.

Trusting that Mr. Egner will not only continue his investigations, but that he will continue to give the fraternity the benefit of the knowledge thus gained, I am

Yours truly,

Emerson McMillin.

The Market for Gas Securities.

There is nothing of interest to report in connection with the market for city gas shares. Fluctuations in Consolidated quotations have been confined to fractions either way, and it is noteworthy that while the general market for railway shares broke many points, during the semi-panic hours of a fortnight or so ago, Consolidated yielded but slightly. Equitable is steady, and its managers have declared a dividend of 2 per cent., payable Jan. 15. Mutual ought to be a purchase at the offering price of 102. The Brooklyn situation remains unchanged, but it may be asserted, and safely, come what will, that old Brooklyn gas is at bed rock. The Citizens Company paid a semi-annual dividend of 3 per cent. on Jan. 1st. Metropolitan Company an equal return on same date. The Fulton Municipal dividend of 3 per cent. is payable on Jan. 15. In out-of-town shares Laclede, of St. Louis, Mo., presents a sharp advance, 112 being freely bid, while holders ask 115. On Jan. 1st the Providence (R. I.) folks paid a dividend of $1 per share, and the New Orleans (La.) Company, on Jan. 15th, disburses a dividend of $3 per share—this latter being at the rate of 6 per cent. per annum.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

January 3.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	78	78½
Central	440,000	50	—	—
" Scrip	220,000	—	47	57
Equitable	2,000,000	100	113	—
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	113
Mutual	3,500,000	100	100	102
" Bonds	1,500,000	1000	100	—
Municipal, Bonds	750,000		—	—
Northern	125,000	50	36	—
" Scrip	108,000			
Yonkers		50	51	55
Richmond Co., S. I.	300,000	50	50	—
" Bonds	40,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	101	103
Citizens	1,200,000	20	56	58x
" S. F. Bonds	320,000	1000	—	105
Fulton Municipal	3,000,000	100	130	133
" Bonds	300,000		—	105
Peoples	1,000,000	10	48	51
" Bonds	290,000	—	—	103
" "	250,000	—	—	102
Metropolitan	1,000,000	100	72	75x
Nassau	1,000,000	25	—	100
" Ctfs	700,000	1000	—	101
Williamsburgh	1,000,000	50	118	120
" Bonds	1,000,000	—	—	111
Out of Town Gas Companies.				
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	130	138
" " Bonds.	124,000	—	105	110

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ENGLISH

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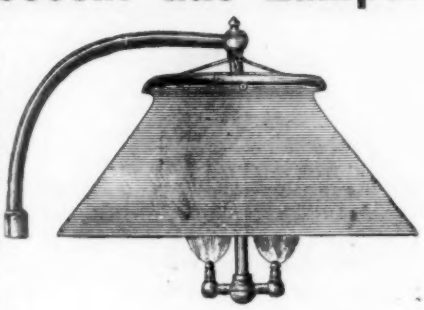
Manufactured under Patents granted and applied for. **Over 20,000 sold in New York and Brooklyn. Over 100,000 sold in the U. S. in one year.** It is the only lamp that can compete with Incandescent Electric Light. Gas Companies should see that it is on sale in their city or town. They can be attached to any bracket or fixture. **A Complete Revolution in Gas Lighting.** The invention of GEO. H. GREGORY, Gas Expert. A pure white light obtained from Gas, which is **Superior to Electric Light.** All lamps are finished in nickel plate. The construction of all lamps allows the gas to be superheated before passing through the tip, rendering the illuminating properties of the gas incandescent, which causes the **Brightest Light ever obtained from Gas.** Lamps made in all sizes. Gas Companies should assist in introducing this new lamp, which exceeds all other devices for gas lighting. This Cut represents Office and Bracket Lamp. Price, **$18 per dozen;** discount 50 per cent. in half dozen lots or more. Send for Catalogue. Address



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It is to the interest of Gas Companies and Cities to use Dyott's Patent Champion Lamps, which give double the light with the same consumption of gas, and will save 50 per cent. over others in cost of keeping in repair. Gas Companies and others intending to erect Lamps of any description will do well to communicate with us. Special Drawings furnished and Estimates given on application upon Architects', Engineers' or our Draughtsmen's Plans.

Our Patent System of Instantaneously Lighting Gas (without electricity) for R. R. Depots is unequaled. Our High Candle Power Burner is superior to the Electric Light or any other High Candle Burner. We manufacture every description of Ornamental Lamps.

Illuminating Gas from Natural Gas,
AS MANUFACTURED UNDER THE
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THE CRYSTAL CARBON LIGHT!
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ADAPTED FOR PRIVATE RESIDENCES, CHURCHES, THEATERS, STORES, ETC.

These Burners are manufactured on the principle of enriching gas by means of Naphthaline (so-called Crystal Carbon or Albo-Carbon), the invention of the Rev. W. R. Bowditch, F.R.S., of Wakefield, England, who was the original inventor and patentee of this system of gas lighting.

SPECIAL NOTICE.

Many Gas Companies find the Crystal Carbon Light a valuable competitor against the Electric Light. It is ornamental, free from the defects common to all other enriching gas burners, and is as cheap as ordinary gas chandeliers. We sell direct to gas companies, giving them the benefit of agents' discounts.

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A new and superior preparation for enriching gas used in conjunction with Crystal Carbon or Albo-Carbon gas lights. The preparation is cleaner and better adapted for filling burner vessels than any hitherto produced. Guaranteed to be chemically pure. Supplied in cans from 10 pounds up.

THIS IS THE CHEAPEST AND PUREST FORM OF ENRICHING MATERIAL.

CRYSTAL CARBON LIGHT CO.,
Main Office, No. 1018 Chestnut Street, Philadelphia, Pa.

TO ALL WHOM IT MAY CONCERN.

Notice is hereby given that a suit is now pending in the U. S. Circuit Court for the Northern District of Illinois against the Chicago Gas Apparatus Manufacturing Company and Newman A. Ransom, for infringing our rights under Letters Patent of the United States No. 247,925, dated October 4th, 1881, and No. 333,862, dated January 5th, 1886; and that a similar suit for like infringement has been instituted against W. S. Horry (trading as the Crystal Carbon Light Company), Arthur Kitson (trading as Kitson & Co.), and others, in the U. S. Circuit Court for the Eastern District of Pennsylvania. All persons in anywise infringing upon our rights under said Letters Patent will be prosecuted by us upon our obtaining proof of such infringement.

WALTER J. KIDD, General Manager.

THE ALBO-CARBON LIGHT COMPANY, - - NEWARK, N. J.
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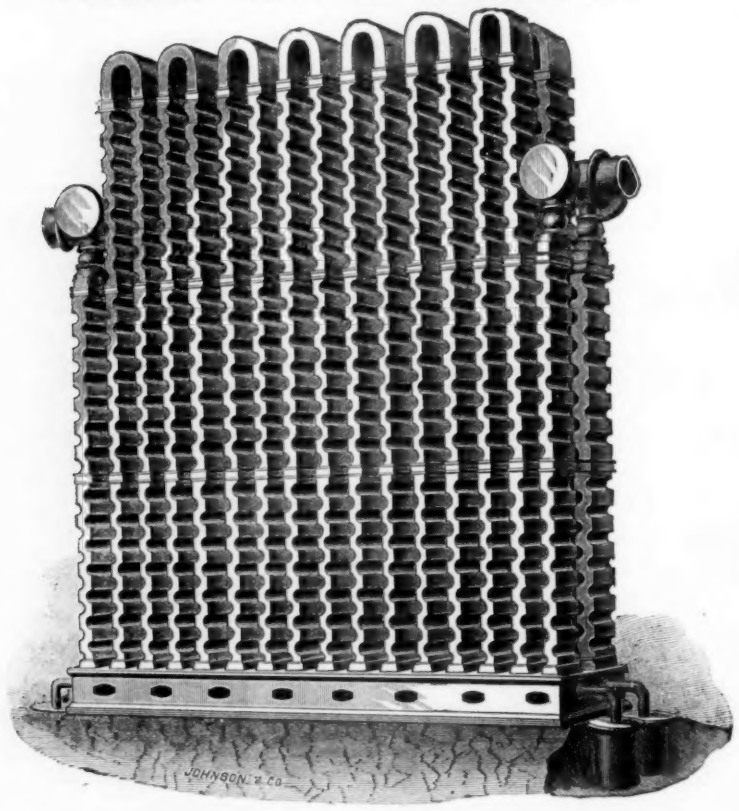
F. J. DAVIS & J. R. FARNUM,

TRUSTEES AND AGENTS FOR THE

SINUOUS FRICTION CONDENSER.



We desire to draw the attention of the gas community to the merits of the SINUOUS FRICTION CONDENSER. Companies intending to introduce new condensers into their works will do well to confer with us and examine plans and estimates before contracting for any other pattern The FRICTION CONDENSER is now in use at the gas works located in the following places:

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Newport, R. I.	Chelsea, Mass.	Jamaica Plain, Mass.	St. John, N. B.
Gloucester, Mass.	Woburn, Mass.	Attleboro, Mass.	Paterson, N. J.
Newton & Watertown, Mass.	Peoria, Ill.	Calais, Me.	Dover, N. H.
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1886

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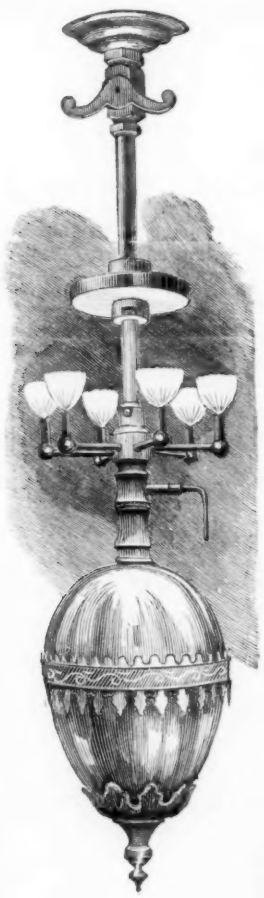
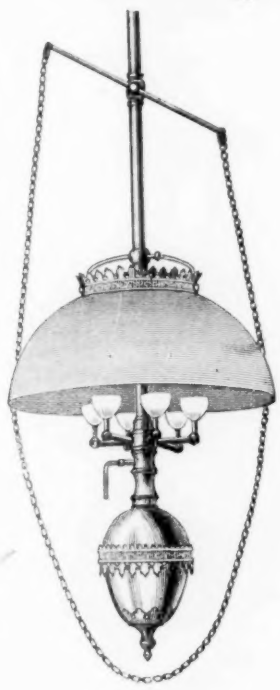
Wellington Light & Heat Co., Wellington, Kansas.— Daily capacity, 120,000 cu. ft.
Chippewa Falls, Gas Light Co., Chippewa Falls, Wis.— Daily capacity, 120,000 cu. ft.
Elkhart Gas Light & Coke Co., Elkhart, Indiana.— Daily capacity, 120,000 cu. ft.
Madison City Gas Light Company, Madison, Wis.— Daily capacity, 120,000 cu. ft.
South Bend Gas Light Co., South Bend, Indiana.— Daily capacity, 250,000 cu. ft.
Sheboygan National Gas Comp'y, Sheboygan, Wis.— Daily capacity, 120,000 cu. ft.
Salina Gas Light Company, Salina, Kansas.— Daily capacity, 120,000 cu. ft.
Rathbun Company, Deseronto, Province Ontario.— Daily capacity, 80,000 cu. ft.
Jefferson City Gas Light Co., Jefferson City, Mo.— Daily capacity, 120,000 cu. ft.
Mankato Gas Light Company, Mankato, Minnesota.— Daily capacity, 80,000 cu. ft.
Minneapolis Gas Lt. & Coke Co., Minneapolis, Minn.— Daily capacity, 1,000,000 cu. ft.

1886



THE ALBO-CARBON LIGHT.



This most successful of all methods of enriching gas is based on the use of heated gas to vaporize a solid hydrocarbon, thus

COMBINING THE ADVANTAGES OF PREHEATING AND CARBURETTING.

The incoming gas passes over an extended heating surface (heated by means of the illuminating flames), and is raised to the temperature necessary to vaporize the carburetting material, which is a white, crystaline solid prepared from coal tar.

Two Seasons of Practical Use in all parts of the Country have amply demonstrated that the Albo-Carbon Light stands unrivaled for

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Gas Companies are Finding this System Superior to All Others

in enabling them to meet competition, as its adaptability to various requirements makes it equally as desirable to replace a KEROSENE LAMP, an INCANDESCENT LIGHT, or an ARC LIGHT.

Our Apparatus are made in all Sizes, from 1 to 48 Lights (25 to 1,500 C. P.)

To enable Gas Companies to still more successfully meet this competition and to offer to the public still cheaper forms of our lights, we have added

New and Attractive Designs at Low Prices.

Send for Illustrated Catalogue and New Price List.

NOTICE.

Suits are pending in the U. S. Circuit Courts in Illinois and Pennsylvania against various persons for infringement of our Letters Patent No. 247,925, dated Oct. 4, 1881, and No. 333,862, dated Jan. 5, 1886. All persons are cautioned against manufacturing, selling, or using any apparatus or material which infringes our Patents. We intend to commence suits against all parties infringing Patents owned by us.

The Albo-Carbon Light Co.,

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Made in Sizes of 5, 10, 15, 20, and 25 Horse Power. All Engines Guaranteed for One Year.

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By C. J. R. HUMPHREYS.

A Pamphlet of twenty-n ne pages, treating of the use of Gas as a source of Light, Heat, and Power.

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AUTOMATIC GOVERNOR FOR STREET MAINS.

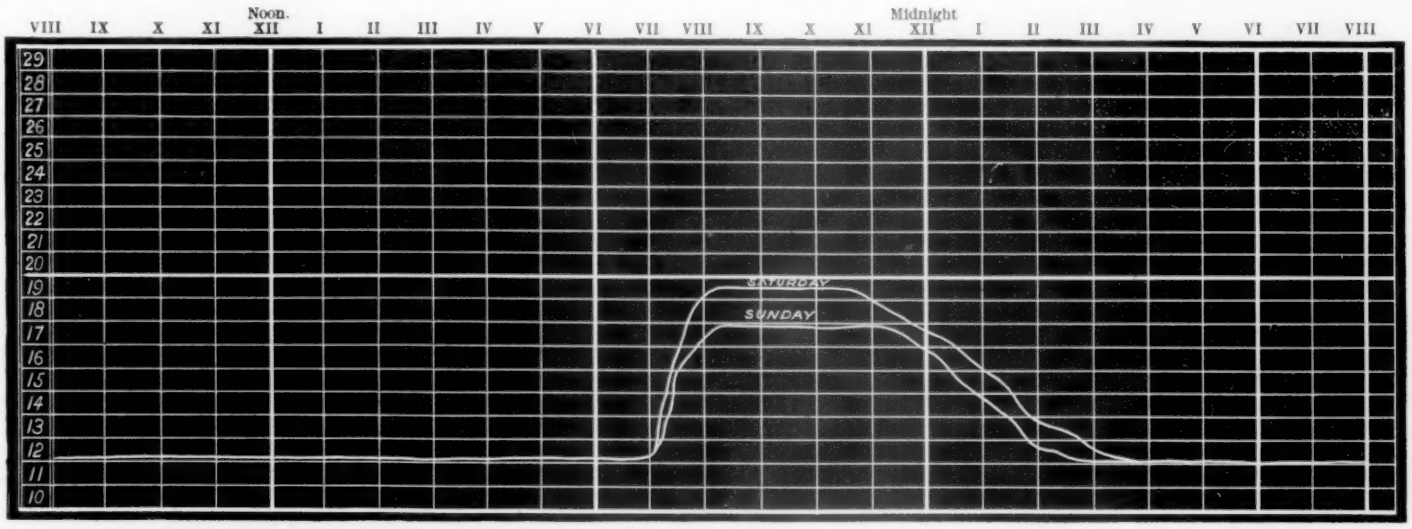
We invite the attention of all practical Gas Managers to the following letter and accompanying cut. The two lines show the pressure held by the Governor on Saturday and Sunday, and clearly illustrates the accuracy of the Governor in *increasing* and *reducing* pressure *in proportion to the volume of gas consumed.*

A Governor that puts the increased pressure on at "one fell swoop" and takes it off in like manner is *not* an "Automatic" Governor; and the circulation of pressure sheets showing such action by a so-called "Automatic" Governor is a rather amusing reflection on the intelligence of Gas Managers.

Strictly speaking, a "Balanced" Governor is an "Automatic" one, as it automatically varies the volume of gas sent out to *maintain a uniform pressure* at its outlet. But, as now applied, the term "Automatic Governor" is understood to mean a Governor that will *maintain pressure between any two desired extremes, in direct proportion to the volume of gas consumed.* Therefore pressure sheets showing *instantaneous changes* from maximum to minimum and *vice versa*, circulated broadcast as the record of an "Automatic (?) Governor," reveals inexcusable ignorance of the subject, amusing to many, yet liable to mislead the inexperienced novice.

We would suggest that all Gas Companies contemplating the placing of *Automatic* Governors would consult their own interests and avoid annoying experience by adopting a Governor *that has a record.*

CONNELLY & CO., LTD., 177 Broadway, N. Y.


VIII IX X XI Noon. XII I II III IV V VI VII VIII IX X XI Midnight XII I II III IV V VI VII VIII
29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10
SATURDAY
SUNDAY

Card Showing Pressure at the Milwaukee Gas Works, Saturday, July 10, and Sunday, July 11 1886.

MILWAUKEE, WIS., August 3d, 1886.

MESSRS. CONNELLY & CO., LTD., 177 Broadway, New York:

Gentlemen—Replying to yours of 29th, I send you a little package of register sheets. When your Governor (20-inch) was set I adjusted it to give 13-tenths day pressure and 22-tenths night pressure. Saturday nights it would run up to 25-tenths. Whenever it would cloud up in the daytime it would go up at first indication of darkness to about 15-tenths. I hunted back in the sheets to find one when pressure was increased in the daytime, but it is so long since we have had a stormy day I could not find one. You can, however, see a *slight change* on sheets for June 1 and June 25. You will see, too, that lately the Governor only puts on *about* 20-*tenths maximum pressure.* This is because *less gas is burned than when it was adjusted.* We have no complaints of pressure, and everyone appears satisfied. In conclusion, can say the Governor has *never been touched* since it was first adjusted, and has at all times *done just the work we wished it to do.* Very truly yours, E. G. COWDERY, Engr. & Supt.

T. C. HOPPER'S

AUTOMATIC DIFFERENTIAL GAS GOVERNOR

Is now in Practical Operation, doing Perfect Automatic Service with Great Precision.

This Governor will do all and more than any other Governor on the Market.

BE SURE TO THOROUGHLY INVESTIGATE THE SUPERIOR MERITS OF THIS GOVERNOR BEFORE PURCHASING.

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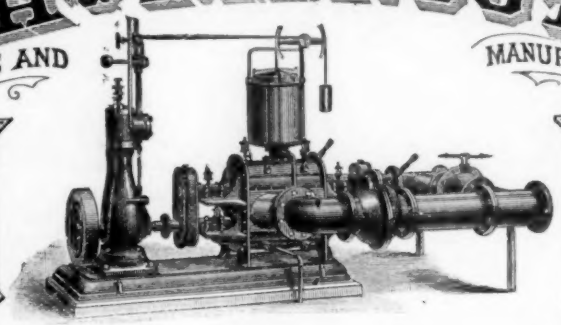

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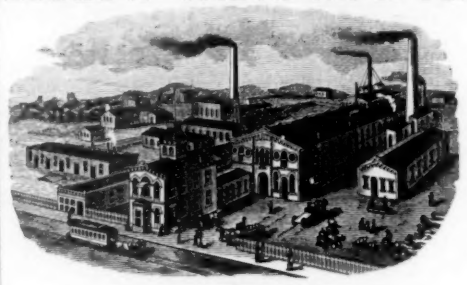

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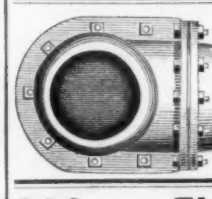

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This is a subject of special interest to all Gas Light Companies.

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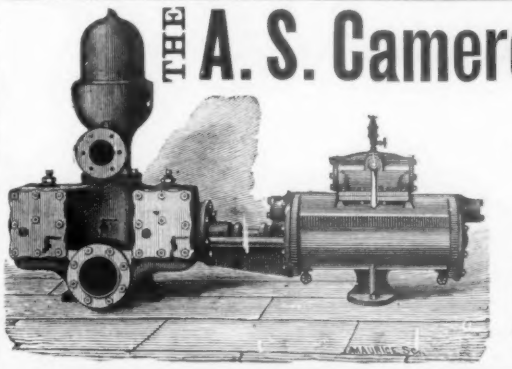

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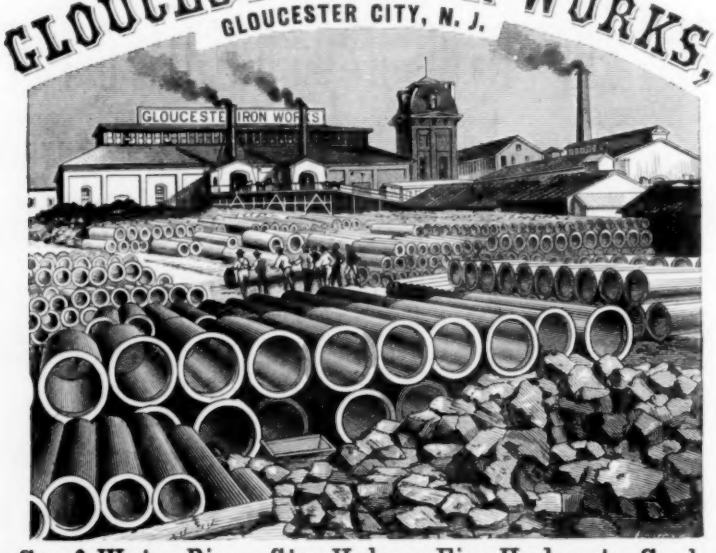

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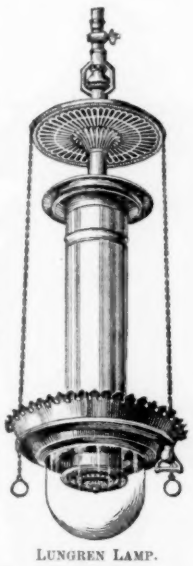

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THIRTEEN CANDLE POWER PER CUBIC FOOT OF GAS!

This result is obtained

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Consequently this largely increased illumination is always maintained without further cost and frequent attention.

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NO OTHER APPARATUS REMOVES ALL THE AMMONIA FROM THE GAS.

Its dimensions admit of placing it under cover without the great expense incurred in a high building to protect Tower Scrubbers from changes of temperature; thus the "Standard" Washer-Scrubber costs much less than other systems.

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VALVES, BENCH WORK, FIRE HYDRANTS,
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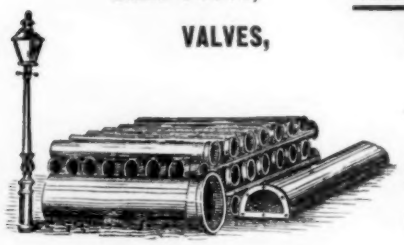
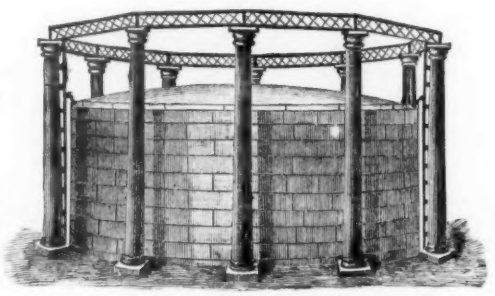
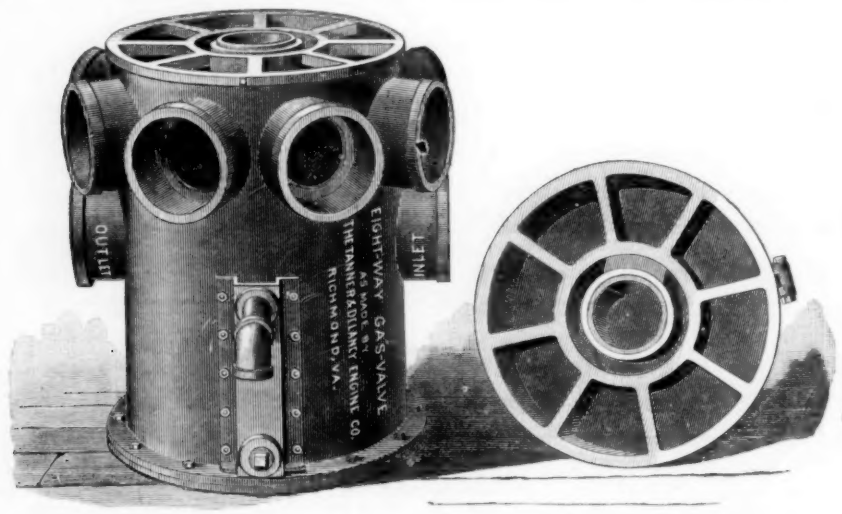


Estimates and Specifications for NEW WORKS or EXTENSIONS or ALTERATIONS of OLD ONES.





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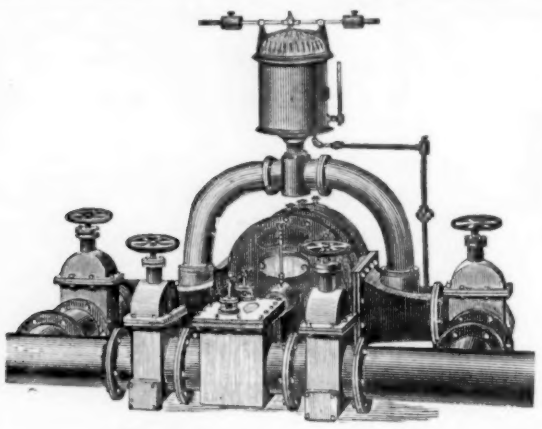

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" "	"	220,000	"
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Youngstown, Ohio	"	60,000	"
Canton, "	"	60,000	"
Akron, "		80,000	"
Xenia, "		10,000	"
Adrian, Mich	"	65,000	"
Ypsilanti, Mich	"	25,000	"
Muskegon, "	"	70,000	"
South Bend, Ind	"	70,000	"
Anderson, "	"	20,000	"
Plainfield, "	"	10,000	"
Springfield, Illinois	"	100,000	"
Evanston, "	"	50,000	"
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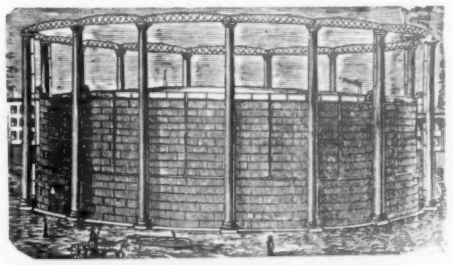

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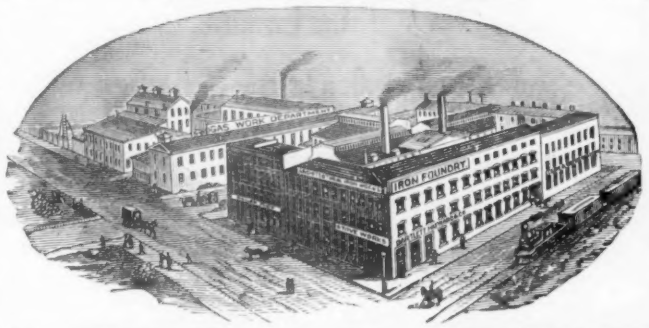

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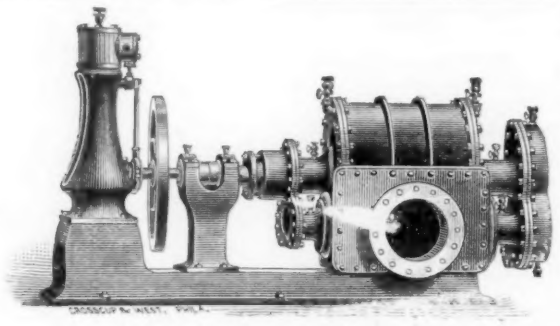

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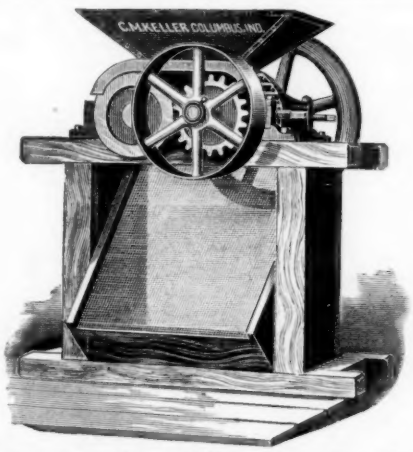

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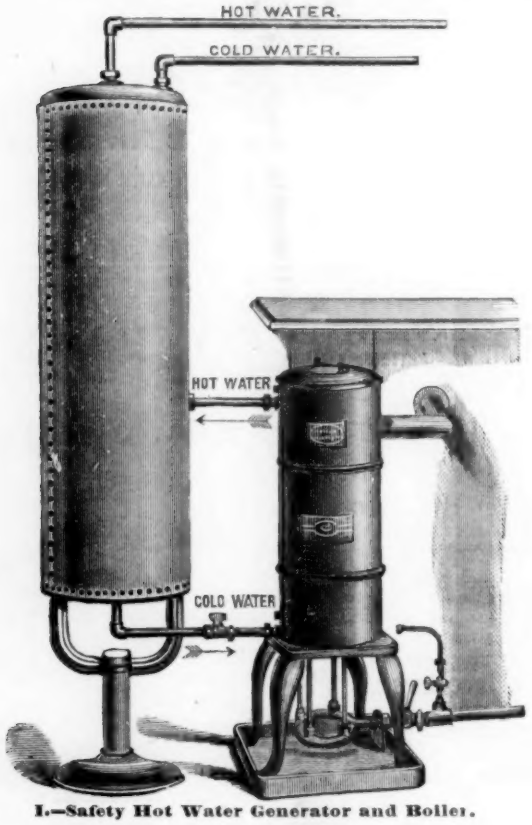

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